

SCIENCE

[Entered at the Post-Office of New York, N. Y., as Second-Class Matter.]

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

SEVENTH YEAR.
VOL. XIII. No. 324.

NEW YORK, APRIL 19, 1889.

SINGLE COPIES, TEN CENTS.
\$3.50 PER YEAR, IN ADVANCE.

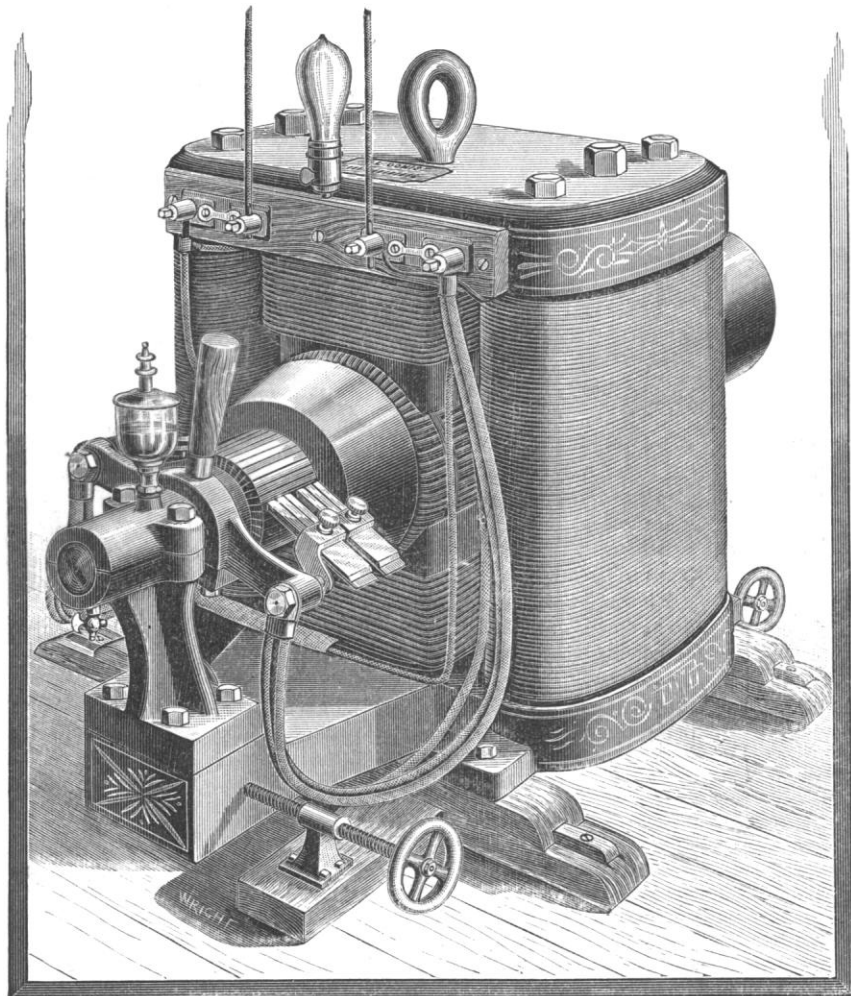


FIG. 1.



FIG. 2.

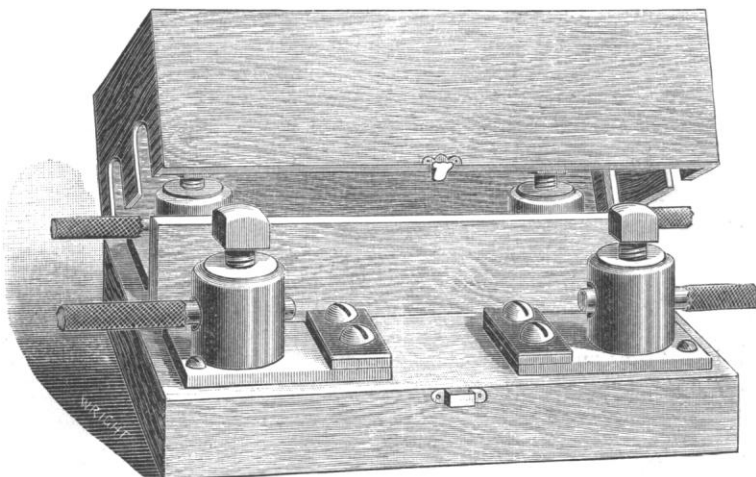


FIG. 3.

THE LOOMIS ELECTRIC-LIGHT SYSTEM.

Fig. 1. Dynamo; Fig. 2. Incandescent Lamp and Socket; Fig. 3. Fusible Cut-Out. [See p. 292.]

THE LOOMIS ELECTRIC-LIGHT SYSTEM.

THE Loomis system of electric lighting, though comparatively new, has been long enough in operation to test the value of the various features peculiar to it, and it has received the indorsement of many establishments in which it is in use. The field in which it

watch either the dynamo or a resistance-box. Moreover, no sparking at the brushes can be detected when the lights are turned on or off.

The self-regulation of the dynamo, which is not obtained by a waste of power in driving the current through resistance coils or in weakening the current by shifting the brushes from the point of

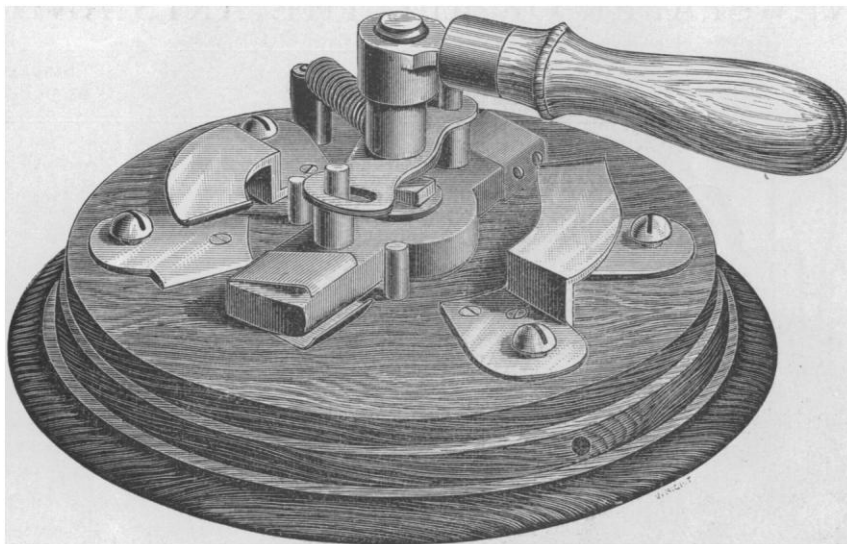


FIG. 4.—DOUBLE-POLE SWITCH.

is best known extends through the Eastern and Northern States, from Maine to Michigan.

One feature of the Loomis system is that the regulation of the dynamo is automatic; that is, that the dynamo "requires no more attention than a line of shafting." So long as the power is supplied and the bearings of the armature-shaft properly lubricated, the required amount of current is supplied, and no more, whether

greatest efficiency, enables the lamps to be kept up to their maximum of brilliancy at a minimum consumption of power, while it is believed that the steadiness of the current extends the life of the lamp to its utmost limit.

The main advantages claimed by this system may be summed up as follows: first, economy in cost of plant, owing to simplicity of construction of dynamos and accessories, and ease of installation; second, economy of maintenance, power being used only in proportion to the amount of light furnished, and no extra attendant being required; third, exemption from the necessity of stoppage for repairs, as it is maintained that the armature cannot be burned out under any circumstances; fourth, the light is steady; fifth, owing to absence of variation in the intensity of current, the lamp lasts longer than in systems where such conditions do not prevail.

The company maintains that the lamps are practically the only destructible parts of their system, and they guarantee them an average life of at least six hundred hours. They have on record one case in which 42 lamps in an installation of 123 are always lighted whenever the dynamo is in operation. Of these 42, 34 were still in use after 2,162 hours' service. Of this same installation, which is in a paper-mill at Holyoke, Mass., the treasurer of the paper company says, "I find I can cut out 122 of 123 lamps without increasing the brilliancy of the remaining one or causing any spark to form at the brushes."

The Loomis dynamo is shown in Fig. 1; the lamp and socket, in Fig. 2, the sockets being of such a design as to guard against liability to short-circuiting. Fig. 2 shows the actual size of a 16-candle-power lamp. Fig. 3 is a fusible cut-out. It has ample contact surfaces for the fuses, and consequently is not liable to give trouble by unnecessarily burning out. The switches, both double-pole and single-pole, have large contact surfaces, and make the break instantaneously. The double-pole switch is shown in Fig. 4. This company furnishes ammeters, voltmeters, ground detectors, and other electrical appliances and safety apparatus required for incandescent plants. The voltmeter is shown in Fig. 5. At an early date they will have ready a motor embodying the same general features as their dynamo.

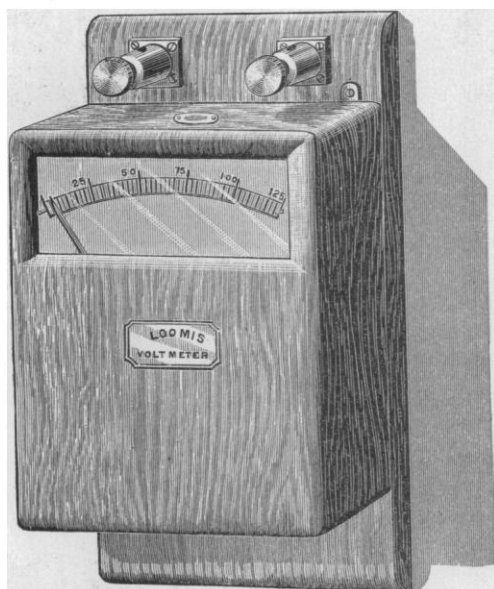


FIG. 5.—VOLT METER.

there be only one lamp in circuit or the maximum number for which the machine is intended. The quantity of current is diminished as the lamps are extinguished, and increased as they are lighted, without any attention being paid to the dynamo, and it is claimed that power absorbed by the dynamo is in proportion to the number of lamps in actual use. The regulation of the dynamo so as to secure these results is accomplished by a simple method. There is no shifting of the brushes required, nor is any resistance introduced into the circuit, so there is no attendant required to

A CAVE of unexplored dimensions, containing a beautiful lake, the shores of which are covered with human bones and pieces of pottery, was discovered recently by two miners near El Paso, Tex.

AYRTON AND PERRY'S IMPROVED AND NEW AMMETERS AND VOLTMETERS.

WE take pleasure in placing before our readers a description of the latest instruments of the well-known electricians, Professors Ayrton and Perry. Quite a full description of these remarkable

production of instruments without permanent magnets, they having found out by experience, that, no matter how well such magnets are aged, they will change in their strength, which makes them unfit for instruments which will be very accurate for any length of time. They discovered some years ago that a spring made of flat ribbon wound in corkscrew fashion will produce a very great rotary

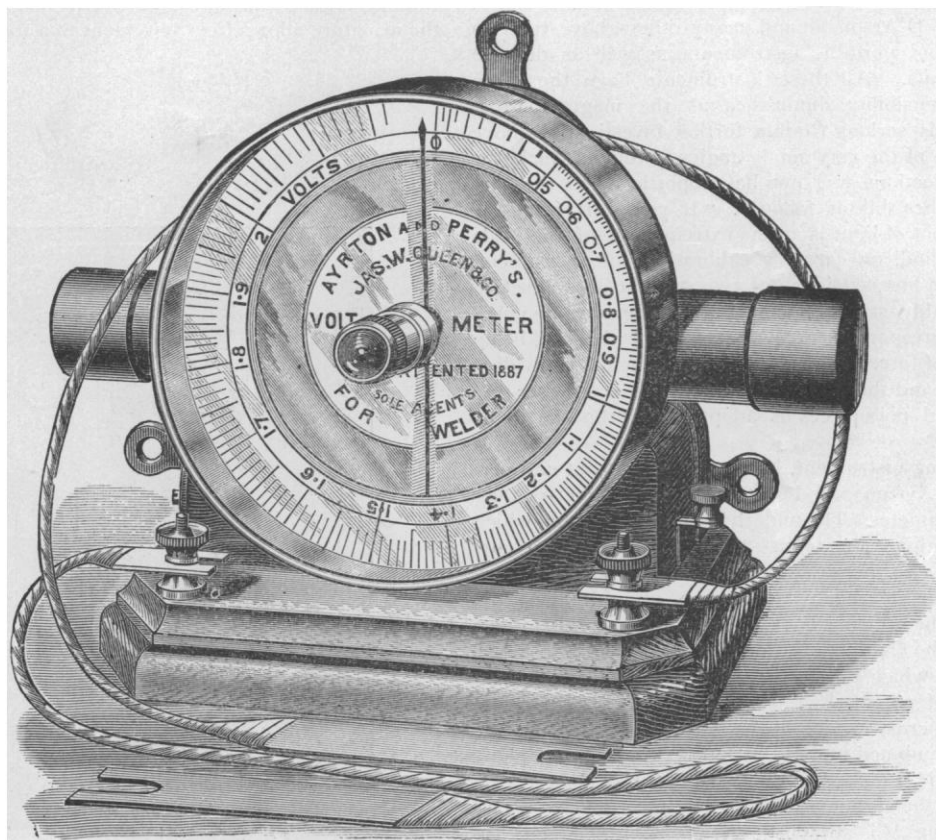


FIG. 1.—HOT-WIRE VOLTMETER.

instruments has just appeared in the London electrical journals, and has been copied in the American journals. We are, however, in a position to give some very important data recently received directly from Professors Ayrton and Perry, through their sole agents in the United States, Messrs. James W. Queen & Co., Philadelphia. This additional information not only covers great improvements

motion on one end free to move, while the other end is held in its place. This spring is used in all their new instruments, the permanent magnets having been discarded as early as 1883. Ayrton and Perry have perfected the methods of testing and calibrating their instruments, and we shall soon be able to give a full illustrated description of their laboratories.

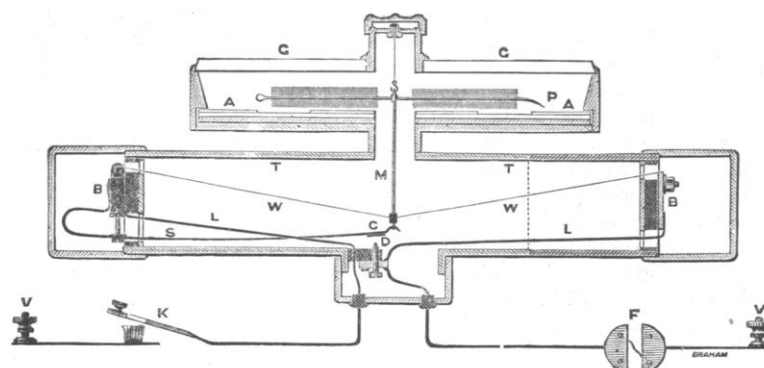


FIG. 2.—HORIZONTAL SECTION OF HOT-WIRE VOLTMETER.

which they have made in their well-known magnifying spring instruments, but also a full description of the hot-wire voltmeter, the first samples of which have just been received by J. W. Queen & Co. It is a well-known fact that the practical instruments which Ayrton and Perry have invented are now more largely used than any instrument upon the market. If we examine the work of these two eminent men in the line of testing-instruments, we will see that they have been largely devoting themselves of recent years to the

Very extensive experiments and investigations have furnished the necessary data to make these spring instruments the most accurate technical instruments in the market. It is very interesting indeed to follow Professor Ayrton's general reasoning, which gives a mathematical law to even the most minute things in reference to these instruments. Among his latest discoveries is that platinoid wire is the best material to wind voltmeters to reduce the errors of temperature influence. In a very interesting description of the testing-

laboratory in which the ammeters and voltmeters are calibrated, we find some very important points about the D'Arsonval galvanometer. Numerous attempts have been made to use this form of galvanometer as direct-reading ammeters and voltmeters, but the employment of permanent magnets makes their instrument one of only a very limited degree of permanent accuracy. The same principle is employed by Sir William Thomson in his siphon recorder; and Messrs. Deprez and D'Arsonval, and many others, have tried to make commercial and portable instruments, as well as delicate laboratory instruments. All these instruments have the same defect, that their sensibility diminishes as the magnets grow weaker. Besides this serious trouble, further investigations have shown, that, in spite of the very small angles through which the coil moves, the deflections will not be proportional to the current. Ayrton describes this as follows: "If you start from the centre, so that the spot of light is at one extreme end of the scale for no current, you find, on carefully calibrating the instrument, that you get a broken line consisting of two straight lines meeting at an angle, or probably, strictly, meeting according to some curve at about the spot corresponding with the plane of the coil, being parallel to the lines of force. Hence there is a difficulty in dividing the scale uniformly; and this difficulty is met with even when the plan of using curved pole-pieces is adopted, as proposed by us some six years ago."

The most interesting instrument, however, brought out and perfected by Professors Ayrton and Perry, is the new direct-reading hot-wire volt- and ammeter. The underlying principle is that which is used by Cardew in his voltmeters,—that the passage of a current will heat a wire, and thereby lengthen it. Ayrton and Perry had an excellent means in their patent springs of multiplying the minute changes of the dimensions; and the employment of this very spring reduces the Cardew of three feet length and four yards of fine wire to one in which eight inches of wire are sufficient to indicate differences of potential of less than $\frac{1}{100}$ of a volt. The above figure shows a cross-section of the instrument as at present constructed. The combined pull of the spring *M* and of the platinum silver wire *WW*, attached to the blocks *B, B*, is counterbalanced by the pull of the spring *S*. Hence, as the wire stretches, the magnifying spring *M* is stretched, and the point *P*, to which a number of fine hairs are attached to introduce damping without solid friction, rotates. The flat spring is not only introduced to enable the depth of the instrument to be diminished by twice the sag of the wire, but to enable a particular arrangement of fuse to be employed.

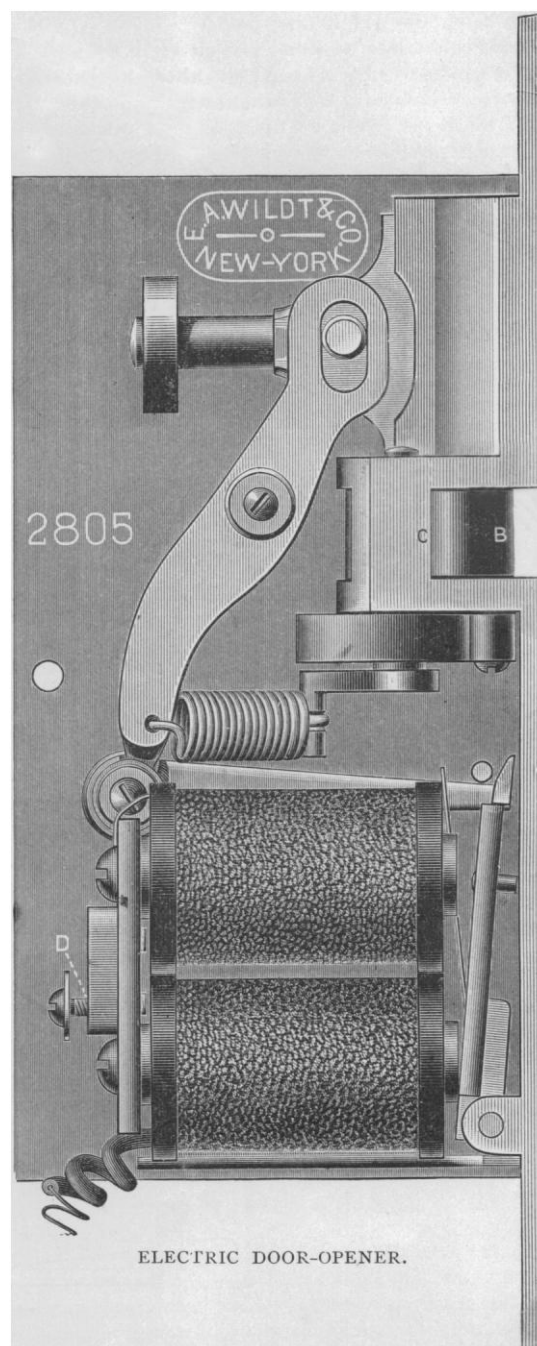
The fuse *F* is of such a diameter that it would require a far larger current to melt it than would damage the instrument. In addition, a platinum-tipped screw, *D*, is arranged so that when the wire *WW* stretches by any pre-arranged percentage beyond the amount it stretches for the maximum safe potential difference, the platinum tip *C*, of the flat spring *S*, comes into contact with the screw *D*, and the working wire is short-circuited. The circuit is then temporarily completed through the lead *L*, to the left of the flat spring *S*, and the fuse *F*, when the current increases and the fuse melts without damage to the instrument. With this device, they find that the fuse may be thick, and therefore have but a small resistance compared with that of the working wire, and yet the sudden application of a potential difference five or six times as great as the maximum potential difference the voltmeter is intended to measure, melts the fuse without damaging the working wires. For clearness, the fuse, the key, and the terminals *V, V*, are shown detached from the instrument, but they are in reality in the base, as seen in Fig. 1.

AN ELECTRIC DOOR-OPENER.

AN improved electric door-opener, manufactured by Wendt & Co., of this city, is shown in the accompanying illustration. It requires but small battery power. The wires are concealed from view; and a slight pressure on the ordinary electrical push-button not only releases the latch, but causes the door to be thrown open. The closing of the door resets the opener automatically.

The mechanism of the door-opener is simple. *B* is a throw-back, which swings on a pivot to which is attached the inner end of a

coiled flat spring. To a crank on the end of the pivot, outside the coiled spring, is attached a spiral spring. The closing of the door swings the throw-back around on its pivot, thereby compressing the coiled spring, which is of sufficient strength to force open a heavy door when released. The spring is prevented from acting until the armature, which is pivoted at the lower right-hand corner of the opener, is attracted by the electro-magnet. The movement of the armature allows free movement to a tongue pivoted to the up-



per left-hand corner of the electro-magnet, against which the latch-bolt lever bears. The action of the opener is as follows: When the circuit is closed by a touch on the button, the armature is attracted by the electro-magnet; the tongue moves, thereby releasing the spiral spring, which pulls back the latch-bolt; and at the same time the coiled spring forces the door open by means of the throw-back.

THOMAS WHITTAKER has just published "The Washington Centennial Souvenir,"—a large, finely printed, and handsomely illustrated brochure arranged by Frederick Saunders of the Astor Library.

BUILDING-STONES OF EAST TEXAS.

It is generally supposed that building-stones are very rare in eastern Texas, and that nothing harder than a clay or sand bed is to be found. This is far from true, according to R. A. Penrose, jun., in the *Texas Geological and Scientific Bulletin* for March, as there are found in many of the eastern counties rocks which combine variety and beauty with strength and durability. The sand-stones are the most important; the limestones, though equally serviceable, being less widely distributed.

The State Penitentiary, at Rusk, is built of a yellow sandstone composed of grains of silicious sand and altered greensand. It is of a yellow color, easily cut, and occurs near the penitentiary in a bed about twelve feet thick. This Claiborne greensand itself is also used extensively for building chimneys and foundations, and in many cases it might be used for more extensive structures. It is found in many places in the form of a yellow indurated mass, the color being due to the alteration of the greensand. It is also found of a green color and a compact clayey consistency. Both these varieties are found in many places of sufficient strength to prove of considerable value in building, though they are generally soft and crumbly.

Near Alto, in Cherokee County, and elsewhere, is found a white sandstone, very tough, hard, compact, and durable. It is in some places slightly colored by oxide of iron, but in others is of a pure snow-white. It occurs in a bed capping the Claiborne marls, and varies from one to three feet in thickness. This would prove a most serviceable rock for building-purposes; and where it preserves its white color, without blotches from iron, it is by far the most beautiful rock in eastern Texas. It has as yet been but little used, but, with the rapid start in the development of its resources that eastern Texas is taking, it is bound to find the place it deserves among the stones of the State. A variety of it from five miles west of Jacksonville is said to have been used with great success for mill-stones. It is also found in other places.

Brown sandstones of variable composition and hardness are found in many places, and are the most generally distributed, and consequently most important of the East Texas building-stones. They occur in many localities, and vary from a light brown, soft and easily cut rock, to a hard flinty variety of a dark-brown color. The beds are from one to over fifteen feet thick, lie horizontally, and are usually found capping knolls or hills. They are sometimes the result of induration by the agency of oxide of iron, of quaternary sands, and at others the result of a similar change in eocene sands. The source of the iron solutions which caused this cementing action has been the oxidation of pyrites in the bed, or of ferruginous solutions percolating through the bed and derived from the decomposed pyrites in associated beds, such as pyritiferous lignites, greensands, and clays.

The limestone of Scott's quarry, in Smith County, is a hard, tough, compact gray rock, excellently adapted for building-purposes, and of great durability.

TEXAS ASPHALTUM.

THE absolute need of material suited for serviceable pavements is well known and fully appreciated all over the State of Texas. In some of the principal cities there have been considerable bodies of pavements laid with asphaltum brought from Trinidad, by mixing it with a certain amount of calcareous matter, and heating it to such a point that it would harden on cooling. This is done to imitate the natural mixture of limestone and bitumen found in the deposit of Val-de-Travers, of which the best French pavements are made. Dr. Ure, speaking of these two materials, says: "Bitumen alone is not so well adapted for making a substantial mastic as the native compound of bitumen and calcareous earth, which has been properly called asphaltic rock, of which the richest and most extensive mine is that of Val-de-Travers. The calcareous matter is so intimately combined and penetrated with the bitumen as to resist the action of air and water for any length of time. It would indeed be a difficult matter to combine, by artificial methods, calcareous earth thus intimately with bitumen; and for this reason the

mastics made in this way are found to be much more perishable." In these deductions he is fully borne out by the experience of those using the two materials throughout Europe, and even in this country.

Among the specimens collected by Col. J. L. Tait, on his trip to South-west Texas last November, was a small piece of a dark-blue limestone thoroughly impregnated with bitumen. The rains were so continuous, however, that no detailed examination could be made, but later it was found that the quantity is equal to all demands; and a somewhat larger specimen was obtained and subjected to analysis, with the result of proving it almost identical in composition with that of the Val-de-Travers, as will be seen by the following:—Val-de-Travers: bitumen, 20 per cent; limestone, 80 per cent. Uvalde County: bitumen, 20.35 per cent; limestone, 79.65 per cent.

This, E. T. Dumble, in a communication to the *Texas Geological and Scientific Bulletin*, thinks will prove to be of great and lasting benefit to the State. In addition to this, many deposits of bituminous sands or shales occur which yield ten per cent, and sometimes a larger amount, of bitumen.

EXPLORATION IN MEXICO.

IN the winter of 1887-88, Dr. Ed. Seler undertook a journey to Mexico to pursue archæological researches. A preliminary report of his expedition is given in the "Proceedings of the Royal Geographical Society," from which we learn that he devoted himself principally to researches in the country of the Huasteca and Zapoteca. The important result of his journey is the demonstration of the fact that the apparent and supposed fundamental difference between the Aztec hieroglyphics and the Maya manuscripts does not exist. Dr. Seler, starting from the capital, first visited the Huasteca Indians. Their territory is an extensive forest country. The fertile mountain slopes and river lowlands are everywhere clothed with luxuriant tropical forest, in which fig-trees, and, as underwood, bamboos, are conspicuous. The open valleys and the high ridges which extend between the river-courses are covered with either thin or thick forests of fan-palms. In the clearings, tall, many-colored grasses and mimosa-bushes cover the ground.

The principal villages are situated along the river-courses and upon the plateaus between the rivers. Numerous small ranches are scattered through the woods. The inhabitants are principally engaged in cattle-raising; horses, oxen, and mules living out in the forest, and being driven into the corrals only once a year. The capital draws its chief supply of meat from this province, the cattle being driven to Pachura, whence they are conveyed by rail to the city. Agriculture is carried on only to a very limited extent; and it is a significant fact that this country, which might supply half of the whole republic of Mexico with corn, imports this very article from the United States. There are no irrigation-works, by means of which the destructive effects of droughts might easily be obviated. The Indians grow corn, black beans, and pepper, and make brown sugar and smoked bananas. They manufacture mats from palm-leaves and agave fibre. Candles are made from the plentiful supply of tallow obtained from the cattle. The principal imports are coarse calicoes, ribbons, beads, cheap articles of finery, harnesses, hardware, liquor, and petroleum. There are only very few people who can read and write. Their amusements consist in fandango-like dances, cock-fighting, and horse-racing.

The roads are mere trails cut through the forests, which, in bottom-lands and at river-crossings, are often exceedingly difficult, and impassable to all but native horses. The customary house in the country is the *jacal*, or thatched house (from the Aztec *xacalli*), the walls of which are constructed of bamboo sticks tied together with *Ficus angelica*; while the roof is made of the leaves of the fan-palm neatly plaited, and is absolutely water-tight. In the larger villages there are also houses built of white bricks.

The principal articles of food are black beans, coffee, and cakes of ground corn without salt,—the so-called *tortillas*, which are always eaten hot and fresh. There are no inns, and the traveller has to rely on hospitality.

The antiquities of the country do not consist of such great pyramids as those of Xochicalco, or the palace of Palenque, but they possess a peculiar style of their own, and afford important material for reconstructing the ancient history of Mexico. They are difficult to find, for since the days of Cortes the primeval forest has completely covered and buried them. The houses of the ancient inhabitants stood upon raised foundations, consisting of small pyramids of regularly hewn stones. Among these heaps of stones the largest trees of the virgin forest have expanded, and separated the stones from one another. During the construction of railways, a large number of these pyramids were opened; and in this way a quantity of household furniture has been found, especially painted pottery, and statuettes of beautiful forms, and made of excellent material. The tropical rains also bring to light many objects of the same kind.

Dr. Seler then visited the territory of the Zapotecas, in the state of Oaxaca. The condition of this region is considerably more advanced than that of the country of the Huasteca. The land is richer and better cultivated, the villages better built. Intellectually it is the most advanced state of the republic. The numerous valleys which cut into the high lands, and the numerous rivers which have to be crossed, present special difficulties to the development of trade and commerce. In many cases the river-bed itself forms the road; and in the rainy season, from August to October, intercourse is often interrupted for months at a time.

The territory of the Zapotecas is the land of mounds and bastions. These have partly served as fortifications, partly as tombs, many of which remain to be opened, for the law which prohibits the exportation of antiquities is only too well calculated to discourage explorers. Here Dr. Seler discovered numerous inscriptions and important paintings which had escaped the notice of former observers. The hieroglyphics discovered on the national sanctuaries of the Zapotecas may, should they be completely deciphered, afford a key to the proper understanding of the connection between the Maya and Aztec civilizations.

HEALTH MATTERS.

Baking-Powders.

PROFESSOR J. W. MALLETT of the University of Virginia has recently made a series of experiments with alum baking-powders, and studied effects upon digestion of the residues left therefrom in bread. A full report has been published in the *Chemical News*. He says that it has been almost universally conceded that alum itself, when added singly to bread or other food, is positively injurious to health; and that its use, even in the small proportion sometimes employed to improve the appearance of bread made from unsound or inferior flour, must be regarded as reprehensible. But since the extensive introduction, in the United States, of baking-powders made with alum and bicarbonate of soda, there has been much dispute as to the harmlessness or harmfulness of the substances which are left in bread made with such powders after the mutual re-action of their constituents and the completion of the baking process.

It has been claimed, by those who advocate the use of cheap baking-powders made with alum as one of the ingredients, that as soon as the mixture of alum (usually first deprived, by heating, of the whole or much the greater part of its water of crystallization, — so-called "burnt alum") and bicarbonate of soda is moistened, as in working it up with flour to form dough, the aluminum sulphate is decomposed, sodium sulphate being formed, with which there also remains sulphate of ammonium or potassium, as ammonia or potash alum has been used; and the aluminum assumes the form of aluminum hydroxide, insoluble in water, and therefore supposed to be inert and harmless in the stomach and alimentary canal. It has been noticed that the aluminum is also partly converted into phosphate in presence of the phosphates naturally occurring in flour, and this has been also taken to be insoluble and inert. It has been further claimed, that, at the temperature of the baking-oven, aluminum hydroxide is itself decomposed, water being given off, and the highly insoluble aluminum oxide, or alumina, left behind, to be discharged from the intestines as might be so much clay or other harmless and indifferent matter.

On the other hand, it has been asserted, by some of those who oppose the use of alum in baking-powders, that the decomposition is not, or may not be, complete, and in any case, that, as all of the constituents of the alum remain in the bread, the action upon the human system must be essentially the same as if the alum itself remained intact.

In the discussion of the effects on health of the residual substances left in bread made with alum baking-powders, there has been a good deal of loose argument, based upon data which were either merely assumed as probable, or were too imperfectly supported by actual experiment. In such experiments as have been hitherto recorded, bearing directly on the question, there are many points left in an indeterminate state, and calling for further investigation in order to clear them up and admit of an impartial conclusion being reached. The work undertaken by Professor Mallett was with a view to furnish some more exact and satisfactory evidence of the kind required for the purpose of reaching such a conclusion.

In the examination, twenty-seven samples, representing seventeen brands, were analyzed. Nearly all contained as their acid ingredient a mixture of alum and acid phosphate of calcium ("superphosphate"). All contained as the alkaline ingredient acid carbonate of sodium ("bicarbonate of soda"). After a most thorough and painstaking inquiry into the whole subject, he reached the following conclusions: 1. The greater part of the alum baking-powders in the American market are made with alum, the acid phosphate of calcium, bicarbonate of sodium, and starch; 2. These powders, as found in retail trade, give off very different proportions of carbonic-acid gas, and therefore require to be used in different proportion with the same quantity of flour, some of the inferior powders in largely increased amount to produce the requisite porosity in bread; 3. In these powders there is generally present an excess of the alkaline ingredient, but this excess varies in amount, and there is sometimes found, on the contrary, an excess of acid material; 4. On moistening with water, these powders, even when containing an excess of alkaline material, yield small quantities of aluminum and calcium in a soluble condition; 5. As a consequence of the common employment of calcium acid phosphate along with alum in the manufacture of baking-powders, these, after use in bread-making, leave, at any rate, most of their aluminum in the form of phosphate (when alum alone is used, the phosphate is replaced by hydroxide); 6. The temperature to which the interior of bread is exposed in baking does not exceed 212° F.; 7. At the temperature of 212° F., neither the "water of combination" of aluminum hydroxide, nor the whole of the associated water of either this or the phosphate, is removed in baking bread containing these substances as residues from baking-powder; 8. In doses not very greatly exceeding such quantities as may be derived from bread as commonly used, aluminum hydroxide and phosphate produce, or produced in experiments upon himself, an inhibitory effect upon gastric digestion; 9. This effect is probably a consequence of the fact that a part of the aluminum unites with the acid of the gastric juice, and is taken up into solution, while at the same time the remainder of the aluminum hydroxide or phosphate throws down in insoluble form the organic substance constituting the peptic ferment; 10. Partial precipitation in insoluble form, of some of the organic matter of food, may probably also be brought about by the presence of the aluminum compounds in question; 11. From the general nature of the results obtained, the conclusion may fairly be deduced, that not only alum itself, but the residues which its use in baking-powder leaves in bread, cannot be viewed as harmless, but must be ranked as objectionable, and should be avoided when the object aimed at is the production of wholesome bread.

QUARANTINE CONFERENCE. — The recent quarantine conference which convened at Montgomery, Ala., discussed most thoroughly the question of yellow-fever in all its aspects. As it was composed of the most experienced sanitarians of the country, many of whom have been repeatedly engaged in fighting yellow-fever epidemics, the conclusions of their deliberations are entitled to great respect and consideration. The method of disinfection as practised at the New Orleans station, by the use of superheated steam in steel cylinders under pressure, was indorsed as being the best

method known to science. The surgeon-general of the Marine Hospital service (who was present) was requested and promised to erect at Tampa, Fla., a similar plant. The administration of marine quarantine, as now carried out by the surgeon-general, was especially commended, and the request was made that more stations and more men be devoted by him to this work. The co-operation of the management of the Plant Line of steamers, plying between Havana and Tampa, with Dr. Burgess, United States medical inspector at Havana, was commended as an example for cleanliness of ships, scrutiny of passengers, and disinfection of baggage. By special resolution, the attention of the secretary of the treasury of the United States was called to the prevalence of smuggling between Cuba and the Florida coast, and the great danger of introduction of yellow-fever by this illicit traffic; and he was requested to use additional precautions, and, if possible, put a stop to it. On the question of inland quarantine it was decided, that, as far as possible, this should always be declared, where they exist, by State boards of health; and that by whomsoever declared, within thirty-six hours after the proclamation, comfortable quarters, with provisions and bedding, must be provided for the unfortunates detained at the station. The conference, by a decided vote, refused to indorse the proposition that it was necessary to disinfect a town or city in which yellow-fever had prevailed, but in which there had been no cases for several months, and the place had been subjected to the frosts and freezes of winter; deeming that the use of disinfectants under these circumstances was not only useless, but tended to breed unnecessary terror and distrust not only among the people of the place, but of surrounding States.

TREATMENT OF OBESITY. — Dr. W. T. Smith communicates to the *British Medical Journal* a method for the treatment of obesity which he has successfully employed in forty-three cases, including himself. The plan which he follows is to confine the diet to rump-steak, cod-fish, and hot water for fourteen days, with the absolute exclusion of every thing else. Taking meat in large quantities may lead to dyspepsia, but this can be easily overcome by reducing the meat to an essence. This may be done as follows: Take four pounds of beef free from skin and fat; cut it to pieces about an inch square; place the meat in a close-fitting, air-tight jar; stand the jar in a pan of boiling water, and let it simmer for six hours. Pass the juice of the meat thus obtained through a sieve; then measure four ounces of the fibrine of the meat; pulverize it in a mortar, and stir it up with the essence; divide this into four doses, and you will obtain the nitrogenous elements required of the quantity of meat to be taken at one meal. There is also a similar way of obtaining meat-essence by using a pot called "Boule Américaine." In treating his cases, in several instances he has been obliged to modify the amount of hot water, and lessen occasionally the quantity of meat; but as regards his own personal experience, he found that three pounds of rump-steak and one pound of cod-fish were hardly sufficient to satisfy his appetite. The meat diet and hot water alone must be regularly adhered to for fourteen days; and the amount of hot water taken at any time during the day, commencing at seven in the morning and finishing at half-past ten at night, varies from six and one-third pints, more or less, according to the powers of the patient. The second epoch of twenty-one days the diet may be considerably varied, as he reduces the hot water to four pints in the twenty-four hours; and he allows other kinds of meat, such as mutton-chops free from fat, and chicken; and, as regards fish, grilled turbot, whiting, or soles; a little green vegetable, and some slices of plain unsweetened rusk. The third epoch, thirty-one days, the hot water is reduced to about a quart a day, and he allows tea, stale bottom crust of household loaf, captain's biscuits, grilled fish, fowl, game, turkey, any joint, hock or claret, with seltzer-water, in place of whiskey. As hot water is very unpalatable, a slice of lemon may be added to each tumbler. No case of obesity should be treated by this method when the patient is suffering from any organic disease, unless it be some trifling malady. The loss of weight in nearly all cases will vary somewhat; but Dr. Smith states that his patients bear the treatment exceedingly well, and express themselves as feeling far better in health, and able to take exercise with comfort. The first period of fourteen days is really the only hardship, and he has found very little difficulty in persuading patients to stick to the

diet. As some alkali is essential, he prescribes five grains of the bicarbonate of potassium, to be taken night and morning. Dr. Smith offers to send his diet-cards to any medical practitioner who will write to him, but asking that the result of any case put under treatment be reported to him.

ELECTRICAL NEWS.

The Clark Cell as a Source of Standard Currents.

FOR measuring small currents, there are two methods which should give good results. The first is by the use of an electro-dynamometer, where the mutual actions of circuits carrying the current are balanced by known weights. In this instrument the changes in the magnetic field do not affect the results; and but for its inconvenience, and the fact that continuous readings are impossible, electro-dynamometers would be universally used. In the second method an ordinary galvanometer of any convenient pattern could be employed, provided it could be easily calibrated in order to eliminate errors due to changes in the earth's field or to the field due to magnets on the instrument itself. In order to effect this calibration, Messrs. Threlfall and Pollock have endeavored to obtain a galvanic cell whose electro-motive force will remain constant; and, by sending a current from this through a known resistance, the value of the current is known, and it can be used to standardize a galvanometer meter. In the form of instrument chosen, a movable coil was employed, with an adjustable directing magnet. To calibrate it, the coil was moved to a marked position, a current from the standard cell was sent through it, and the directing magnet moved up or down until the deflection reached a certain set value. This can be easily and rapidly done.

The standard cell was of the Clark type, now almost universally used for comparisons of electro-motive force. From the ordinary type, only an extremely small current can be taken, or the electro-motive force will drop and the cell be ruined. In the type devised by Messrs. Threlfall and Pollock, a much larger surface than ordinarily used was employed. In a paper read before the London Physical Society the gentlemen named give the result of a long series of experiments on these cells. The conclusions at which they arrive are as follows:—

1. When a current is taken from a Clark cell, the terminal electro-motive force drops practically instantaneously to within an inappreciable amount of its final value.
2. To the first degree of approximation, this value is constant.
3. There is no appreciable secular change.
4. When the current is stopped, the terminal electro-motive force rises instantly to within a few thousandths of a volt of the original value.
5. The cell completely recovers in time.
6. The above statements are only true when the current does not exceed a certain value, depending on the size of the cell. For a cell in which the zinc and mercury surfaces have each a value of five inches or upward, .001 of an ampère will not be too great; for the ordinary cell used as a standard of electro-motive force, the current should not exceed one hundredth of this value.
7. When too large a current is taken from any cell, the electro-motive force goes on dropping for some time, after which it rises slightly, and seems to tend toward a fixed value.

THE DETROIT SECONDARY BATTERY. — One of the new secondary batteries which has been attracting considerable attention during the past few months is the Detroit battery, manufactured by the Woodward Electric Company of Detroit, Mich. It is of the Faure type, with a support-plate of lead and active material consisting of salts of lead in cavities in the support. The method of making the support-plate is decidedly novel. Rock salt is put into a square mould, and is baked. Melted lead is then run into the mould and allowed to solidify. The cube thus formed is sawed into plates, and the salt is dissolved out of them by putting in warm water. The result is a plate full of cavities of irregular shapes, having in general an overlapping portion, which prevents the active material from falling out. A solid rim with a lug for a terminal is cast around this central porous portion, and then red lead or litharge is pasted into the cavities. The plates are then put in a cell containing sulphuric acid, and formed by sending a current of electricity from the positive to the negative set. The Detroit batteries have

been pretty extensively employed for lighting, and lately experiments have been made with a view to their adoption for street-car work. A car in Brooklyn equipped with these cells has made over eighty miles with one charge,—a record which has not been equalled; although the distance a car can go does not determine the value of the battery used, since the very important question of weight should enter, and in this case the weight is over five thousand pounds. The Detroit cells have been recently tested at the Johns Hopkins University, and a few figures as to their performance will be of interest. Taking a cell with 15 plates, of which the total weight is 80 pounds, the following results were obtained: charge rate, 15 ampères; discharge rate, 20 ampères; storage capacity, about 220 ampère hours; efficiency, between 75 and 80 per cent. This cell, after experiments at normal charge and discharge rates had been made, was charged at a rate of from 75 to 85 ampères, and discharged at over 250 ampères; and this was done a number of times. At the end of the tests there were no signs of deterioration, which, considering the rough usage to which the cell had been subjected, speaks well for their durability, although the length of the experiments was not sufficient to test their length of life under normal conditions.

THE MAGNETIC PROPERTIES OF NICKEL.—Professor Ewing, whose researches on the magnetic properties of iron are so well known, has examined the magnetization of nickel under various conditions. He finds that nickel behaves very much as iron does when submitted to a magnetizing force. The permeability, or magnetic conductivity, is small at first, then increases to a maximum, then decreases again. The maximum value of the induction obtained was 5,380, so that nickel is about one-quarter as magnetic as iron. When a piece of nickel was heated to redness and then allowed to cool slowly in the air, its permeability increased. On stretching a piece of nickel, its permeability decreased rapidly. For example: a certain specimen of wire had a value of the maximum magnetic susceptibility for no load, of 15. With a load of 13 pounds, this was reduced to 2.6, while at 26 pounds it was but .95. On submitting specimens to compression, the reverse effect was found: as the pressure increased, the magnetic susceptibility increased from 5.6 at no load, to 29.0 at a load of 45 pounds per square millimeter.

A CHALLENGE TO THE WESTINGHOUSE COMPANY.—Mr. Harold P. Brown has issued a challenge to the Westinghouse Electric Lighting Company, to a competitive test of the apparatus of that company against a corresponding continuous-current plant. Each company is to provide a plant capable of furnishing 650 lights. These are to be sent to the Testing Bureau of the Johns Hopkins University, where they are to be tested for efficiency. The loser is to purchase the winning plant, which is to be presented to the university; and he is also to pay all of the expenses of the test. If the Westinghouse Company desires it, they may use one of the Westinghouse engines, while Mr. Brown will employ for the continuous-current plant some other make of automatic high-speed engine. If the Westinghouse Company does not accept the challenge, Mr. Brown will consider himself at liberty to purchase an alternating plant and have the test made. It is to be hoped that the test will be made, as systematic knowledge of the performance of alternating apparatus is wanting, although the marked success of the system speaks well for its efficiency.

THE CONDUCTIVITY OF MICA AT HIGH TEMPERATURES.—W. H. Schultze, in *Wiedemann's Annalen*, describes a number of experiments on the conductivity of mica at high temperatures. It is well known that the conductivity of glass increases rapidly with the temperature, a fact which in many cases is a serious inconvenience. The results of Mr. Schultze's experiments are, that while mica split parallel to the planes of cleavage shares with glass the property of becoming a better conductor as the temperature rises, yet the conductivity reaches a maximum, and after that diminishes until at very high temperatures it becomes infinitely small; so that, comparing glass and mica, it is seen that even at high temperatures the latter is the better insulator.

A. J. DREXEL, the banker, is about to found an industrial college for women at Wayne, Penn., at a cost of \$1,500,000.

NOTES AND NEWS.

SOME interesting experiments were made March 22 near Dartford with the Maxim Nordenfolt quick-firing and automatic guns. As described in *Engineering*, the first weapon fired was the Maxim automatic gun of .45 caliber, and with this 334 rounds were fired in twenty-seven seconds. A comparative test was then made between ordinary rifle-powder and the new Maxim smokeless powder. A cartridge containing 85 grains of black powder, and others containing 55 grains of the new powder, were fired. The last-mentioned cartridges gave a slightly greater velocity, and at the same time produced extremely little smoke. Among the other guns tried was an automatic six-pounder, which has a dropping block like the Sharpe's rifle. It requires only two men to work it, one man firing and the other loading. Every thing about the gun is fixed save the gun itself, which is placed inside a jacket, which latter is also fixed. There can be no danger of escape of gas or from a hang-fire. The gun, on being fired, recoils about $4\frac{1}{2}$ inches, and then returns to its original position. The cartridge-case is not ejected till the gun has travelled some little distance on its return journey. The act of putting in the new cartridge pushes forward the ejectors and releases the block, which rises and closes the breech. If great rapidity is required, one man on a saddle with a butt to his shoulder aims and fires, while a man on each side puts in the cartridges. If only one gunner is left unkilld, a single man can work the gun in the following manner: having laid the gun and fixed the trigger in a firing position by a bit of wood or string, he simply puts in cartridge after cartridge, the gun on each occasion going off as the cartridge is pushed forward. It can be fired, with two men to load, sixty times a minute.

—The kaolin and pottery clays of Texas are beginning to attract considerable attention. There have been representatives of several of the different Northern and Western potteries through the State during the last few weeks, looking up the ordinary pottery clays as well as the kaolin of Edwards and adjoining counties. The deposits of these materials are abundant, and of such quality that they are certain to be brought into market at an early day.

—An English correspondent of the *American Field* writes that a new gunpowder, the invention of Mr. Hengst, has recently been tested at the Royal Gunpowder Factory, Waltham Abbey, England, and the results point to it as a promising substitute for black powder for military and sporting purposes. The new powder is prepared from straw, which is pulverized, chemically treated, and finished in granular form for use. It is claimed for this powder that it is smokeless, flameless, practically non-fouling and non-heating, and that both the recoil and the report are less than those of black powder, with superior penetrative power. From the powerful character of this explosive, which, weight for weight, is 150 per cent stronger than gunpowder, and is not explodable by concussion, it is probable that in a compressed form it will be found to be applicable to blasting-purposes.

—President Patton says that after June 1 the Princeton College will have added to its permanent endowment fund \$250,000 through the kindness of many old and some new friends.

—Mrs. Eliza A. Clark of Cleveland has given \$100,000 to the Cleveland College for Women, a department of the Western Reserve University. One-half the amount is to be expended in erecting the Clark Hall of Liberal Arts.

—The committee on science and art, of the Franklin Institute, has recommended the following awards: of the John Scott legacy medal and premium, to Thomas A. Edison of Orange, N.J., for his invention of the mimeograph, an improved duplicating system and apparatus; of the Elliott Cresson medal, to Edward Alfred Cowper of London, England, and J. Hart Robertson of New York, for their invention of a system of facsimile telegraphy, called "The Writing Telegraph;" of the John Scott legacy medal and premium, to A. A. Marks of New York, for his improvements in artificial limbs; of the John Scott legacy medal and premium, to Thomas Shaw of Philadelphia, for his mine-inspector's gas-testing apparatus; and of the John Scott legacy medal and premium, to Roman

Abt of Luzerne, Switzerland, for his system of railways for steep inclines.

—"According to a careful estimate," says the London *Iron*, "the number of war-vessels launched last year by the naval powers of the world was 60, while more than 100 were building when it closed. England led with 15 vessels launched, and 28 building; France launched 9, and laid down 15; Russia launched 2, and began 10; Germany put 6 vessels into the water, and ordered or laid down 4; Italy launched 10, and laid down 18; Austria launched no vessel, but laid down or ordered 3; Sweden laid down 1; Denmark launched 1, and laid down another; China added 4 vessels to her navy, and ordered or laid down 4 more; Japan ordered 3, and launched 3; the United States launched 6, and laid down 6; Chili ordered a new cruiser in England, and the Argentine Republic contracted for a 4,300-ton ironclad; Brazil laid down a cruiser; and even Uruguay has contributed to the navies of the world, launching a small iron gunboat. The minor powers, like Greece and Portugal, have either contracted for or launched small vessels. Turkey has begun the work of building up her navy, laying down one ironclad and several smaller vessels."

—An article published in the Oil City *Derrick* recently, contains some statements regarding the area and character of the illuminating oil-bearing territory, which *Bradstreet's* believes should be re-assuring to believers in a possible future oil-famine in this country. The oil regions as now developed, the article states, "extend from Wellsville, N.Y., crossing Pennsylvania at nearly a 45-degree line to Dunkard Creek, in West Virginia. On an air line, this covers a distance of 204 miles in length; and, so far as developed, the belt is about 10 miles in width. The yield of the oil-fields up to March 1, 1889, was 340,133,997 barrels. About 150,000,000 barrels of this came from McKean County alone, and this county is still good for 20,000 barrels a day." The total future production of this belt is beyond prediction. It has been noted, says the article, that oil-bearing rock, wherever found, usually yields about the same quantity of oil to a given acre. The yield of oil per square mile of territory during the first fifteen years of its existence is about 1,000,000 barrels. It is considered certain, however, that each of the 204 square miles of territory will not yield this quantity. If it did, the total production there outlined would be about 2,040,000,000 barrels. "This belt of 204 miles is a chain of pools, large and small; and, until the area of each one is known, the total yield would be simply conjecture." The figures and estimates given relate only to the region where the illuminating-oil of commerce is produced; namely, New York, Pennsylvania, and the Macksburg district in Ohio. The great Lima field is not taken into account, nor Colorado, California, Kentucky, or Tennessee. "It has been stated that under the energy of the drill, the Ohio field might be made to yield 100,000 barrels a day. This is not improbable, since the Bradford field in July, 1882, produced 105,102 barrels each day of that month. The Bradford field had no large wells, compared with the geysers of Ohio. Lima oil is worth but about one-seventh as much as the Pennsylvania product, and can never come into competition with it as an illuminant, unless some new process of manufacture is discovered beyond any thing now known. Its utility in the world's economy lies in the direction of fuel, and there is not much likelihood that it will ever be diverted from this field. Natural gas is the only fuel that can compete with it in cheapness, and that is not everywhere obtainable. Natural gas cannot be transported much above 100 miles, and oil-fuel may be carried to the ends of the earth. As far west as Omaha it is now furnishing manufacturers a cheaper fuel than coal." With the above large supplies of oil, both for illuminating purposes and for fuel, in sight, the writer of the article apparently sees little reason to fear an oil-famine, as he states it, as among the immediate probabilities.

—John Ericsson desired that if any biography of him was undertaken, it should be intrusted to his friend, Col. William C. Church, editor of the *Army and Navy Journal*, and the executors of the estate accordingly have turned over to Col. Church all the papers which could be useful in such a work. While it is true that Capt. Ericsson destroyed his diary, all his documents since 1860 were preserved. In private letters and other papers has been

found abundant material relative to his youth and the influences which shaped his early career. Col. Church will contribute some valuable papers embodying much of this material to the fall numbers of *Scribner's Magazine*, which have been prepared by the help of these original documents. They will afterwards be expanded into an adequate biography.

—Another of Dr. Andrew D. White's papers on "The Warfare of Science" will be among the contents of the May *Popular Science Monthly*. This article is devoted to diabolism and hysteria, and will contain accounts of the dancing and other manias of several centuries ago in Europe, and the witchcraft delusion in this country, for which many innocent persons met their death, showing that these epidemics originated in nervous derangements, and were magnified and distorted by false theories. An extended reply to Professor Huxley's article on "Agnosticism," which was published in the last number of the monthly, will appear in the May issue. This view of the other side of the subject is given by Rev. Dr. Henry Wace, principal of King's College, and the Bishop of Peterborough, whose earlier utterances had been criticised by Professor Huxley. Every one who has wondered how the marvellous artistic effects of our best mosaic windows are produced will be interested in the account of a visit to a colored-window studio, which Professor C. H. Henderson will contribute. The article is entitled "The History of a Picture Window," and contains illustrations of the several processes of manufacture. Finally, "The Strange Markings on Mars" is the title of an illustrated article. The author, Mr. Garrett P. Serviss, tells how these markings have been explained, and shows the bearing of what is known about this planet upon the question whether or not it is the abode of life.

—The *Contemporary Review* for April (New York, Leonard Scott Publication Company, 29 Park Row) opens with two timely papers on the political situation in France, by G. Monod and P. G. Hamerton; Professor A. V. Dicey discusses the rights of public meetings, viewing the matter from the standpoint of a lawyer, and not as a politician; the Rev. Horace Waller treats of the slave question in Africa in an article entitled "The Two Ends of the Slave-Stick;" Professor Edward A. Freeman contributes a lengthy paper on Christianity and the "geocentric" system; Dr. Dale continues his interesting papers on Australia, devoting himself this month to a consideration of religion and morals; Dean Plumtre writes an interesting and novel paper on Shakspeare's travels in Somerset, Wales, and the Netherlands, basing his argument on extracts from the plays and poems; James Runciman writes on the ethics of the turf; and Professor Stuart treats of the Metropolitan Police.

—The *Nineteenth Century* for April (New York, Leonard Scott Publication Company, 29 Park Row) opens with a rejoinder on agnosticism, by Professor Huxley, in which he replies to the criticisms made by Dr. Wace in the March number. The Earl of Meath discusses the work of the new London Council, the body that has recently been organized for the government of London. Special importance is attached to the necessity for parks and open spaces for the poor. Lady Blake writes of seals and seal-fisheries. Viscount Powerscourt, a Liberal-Unionist, contributes some casual notes on Ireland. Mr. Scrutton, the president of the Chamber of Shipping of the United Kingdom for 1888, replies to Mr. Plimsoll's paper on marine insurance in the March issue. The Rev. Henry Sidebotham writes on Monte Carlo, pointing out the still numerous errors of the place. W. Frewen Lord describes the British dominion in the Ionian Islands, extending from 1815 to 1863, when they were ceded to Greece. He treats at some length of British misrule, a phase of English history heretofore little understood. Rowland E. Prothero discusses the question, "Is an Agricultural Department Necessary?" which is not without interest to Americans, in view of the recently established department at Washington. Sir William Gregory contributes an interesting series of reminiscences of Daniel O'Connell. Dr. Tuke writes of lunatics as patients, not prisoners. The Marquis of Lorne makes some suggestions for emigrants, with special reference to Canada. Under the head of "Noticeable Books" are brief reviews by Mr. Gladstone, Rev. Dr. Jessopp, Walter Pater, Hamilton Aide, and Fred-eric Harrison.

—Mr. Samuel Cabot, 70 Kilby Street, Boston, in a letter to *Building*, states that the cause of the white efflorescence on bricks has been recently investigated by him, with the result that there are at least three different substances which cause it. Of these, carbonate of soda is most common upon new work, after the lime-stains have been removed. This is due to the action of the lime mortar upon the silicate of soda in the bricks. Silicate of soda seldom occurs in bricks unless the clay used is a salt clay. The only other white efflorescence of importance is chiefly composed of sulphate of magnesia. This is due to pyrites in the clay, which, when burned, gives rise to sulphuric acid, and the latter unites with the magnesia in the lime mortar. The conclusions thus far arrived at are, (1) the "efflorescence" is never due to the bricks alone, and seldom to the lime alone; and (2) to avoid it, the bricks should be covered with an oily preservative capable of keeping the salts from exuding. Linseed-oil cannot fill the requirements, as it is injured by the mortar. Mr. Cabot wishes to investigate the matter still further, and will be obliged to any architects who will send him samples of this substance (say a quarter-ounce) that may come under their observation.

—The directors of the Old South studies in history and politics have included in their new general series of Old South Leaflets a leaflet containing Washington's inaugurals, — the address delivered in New York, April 30, 1789, when Washington first took the oath, and his address to Congress in 1793. This leaflet will be especially interesting at this centennial time, the first inaugural address being nowhere else so easily accessible. The account of the inauguration from Irving's "Life of Washington" is appended, and there are some useful notes. These Old South Leaflets, furnishing so many original papers to the people in such attractive form for only five cents, are a great means of education in history and politics. Washington's farewell address, which, as Senator Sherman recently said, ought to be spread everywhere broadcast among the people, is included in the series, and this deserves new attention now at the time of the Washington centennial. Lincoln's inaugurals are given in another leaflet, and it is useful to compare these with those of Washington. The leaflets are published by D. C. Heath & Co., Boston, New York, and Chicago.

—Some time ago P'au-let, the director of the Nanking arsenal, was commissioned to procure from abroad the requisite machinery for the establishment of a foundry for smelting iron in Kueichow. The machinery, which weighed 1,780 tons, reached Shanghai in three separate consignments, whence it was forwarded by boat to Nanking. Owing to the rapids and shallows in the river between Ch'ang-tê, in Hunan, and its destination, it had to be placed on frames and transhipped piece by piece. The first consignment reached its destination early in August of last year, and the remainder followed closely afterwards. A number of workmen and artisans accompanied it, and, arrangements having been made for putting it together and setting it up at once, it was expected that the furnaces would be in working order within the year. The undertaking being on a very large scale, the funds raised by the issue of shares have not yet sufficed to cover the expenditure, and the governor has been asked to take steps to meet the urgent demand which exists for more money. Kueichow, the governor explains, is an extremely poor province, and its only natural production is iron. Accordingly, permission was obtained from the Throne for sending officers abroad to procure machinery for establishing a smelting-furnace in the Ch'ing district, within the prefecture of Chen-yüan, and thus develop the only resource the province possesses. The great difficulty of inaugurating such an enterprise, says the *Indian Engineer*, is shown by the fact that two years have elapsed before the machinery could be procured from abroad. It has now, however, arrived, and been put up, and the greatest part of the difficulty is over. The quality of the coal and iron obtained in the district is excellent, and the seams in the hills are exceedingly rich. The only drawback experienced has been the difficulty of raising the money at once by shares, which, is, no doubt, due to the fact that the mercantile classes have suffered severely in the past from the insecurity attaching to scrip issued by similar companies, and will not be enthusiastic in subscribing to the present undertaking until they see the furnaces actually at work,

and the iron turned out. The purchase of the machinery, the erection of the buildings, and other expenses, have hitherto been defrayed by loans contracted from merchants, or by temporary appropriation from the *likin* revenue, to be repaid on the receipt of the money from the shares, which, it is expected, will shortly be forthcoming, now that there is every prospect of the foundries being brought into full operation.

—According to the report of the Massachusetts Railroad Commission, there are twelve times as many persons killed and injured at level crossings in that State as in the whole of Germany, though there are nearly twice as many of these crossings in the latter country.

—The *Engineering and Mining Journal* is authority for the statement that at Aitken, Minn., on April 2, at 4.45 o'clock, it became so dark that lights were necessary in business-houses, and the air was filled with snow that is represented to have been as black and dirty as though it had been trampled into the earth. Six ounces of snow and one-fourth ounce of dirt and sand were found in the bottom of a dish. The dirt is very fine, something like emery, and contains particles that have a metallic lustre. This dirty snow fell to the depth of half an inch. The atmosphere at the time presented a peculiar greenish tinge. There was a little wind blowing at the time from the north-west, though there seemed to be a considerable wind higher in the air. Solid chunks of ice and sand are reported to have been picked up in various places.

—A series of articles on submarine boats is now appearing in *Engineering*. Among the earlier forms mentioned is one invented during the American war of independence by David Bushnell of Connecticut, for employment against the British ships of war. It was like a walnut, somewhat flattened, and was sunk and raised by letting in and forcing out water. One oar served for sculling ahead or astern; and another, on the screw principle, placed above the operator, regulated the descent and ascent. When on the surface, an automatic tube supplied the air necessary for one person for half an hour's submersion, and another expelled it when foul. The manhole was covered with a hinged hat-like covering provided with glazed eyelets, and a manometer and compass were illuminated by phosphorus. The torpedo, containing 150 pounds of powder, clock-work, and firing spring, was secured on the top of the boat. A wooden screw manipulated ingeniously through a tube from the interior was meant to be screwed into the bottom of a hostile ship. A line connected this screw with the torpedo, which, when released, floated up by its own buoyancy against the ship's bottom. The boat was then to beat a rapid retreat, and rise again to the surface when at a safe distance. The clock-work, when the time for which it was set had run out, unlocked the striker, causing the explosion. The whole arrangements were well conceived, and, as Washington said, an effort of genius, but requiring too many things in combination for much result to be anticipated from them when employed against a watchful enemy. The boat, manned by Sergeant Lee, who had been previously well drilled in its use, sallied out against Lord Howe's flagship, lying off Governor's Island near New York, and succeeded so far as to get under her without being detected. The screw, however, would not act; and, the sergeant losing his head and his bearings, the attempt signally failed, as did two subsequent ones. Some time afterwards the vessel conveying the boat up the Hudson River was chased and sunk by a British man-of-war, and thus closed the brief career of the first diving-boat designed and used for aggressive belligerent purposes.

—The *Nationalist*, a monthly magazine soon to be issued by The Nationalist Club of Boston, Mass., will have as contributors, Col. T. W. Higginson, Edward E. Hale, Rev. W. D. P. Bliss, Cyrus Field Willard, Edward Bellamy, Rabbi Solomon Schindler, Sylvester Baxter, John Ransom Bridge, Laurence Grönlund, Rev. Albert Lawson, Gen. A. F. Devereux, Henry Willard Austin, Mrs. Mary Livermore, Mrs. Maud Howe Elliott, Mrs. Abby Morton Diaz, Miss Frances E. Willard, Miss A. A. Chevallier, and many others. The declaration of principles of the Nationalist Club reads

as follows: "The principle of the brotherhood of humanity is one of the eternal truths that govern the world's progress on lines which distinguish human nature from brute nature. The principle of competition is simply the application of the brutal law of the survival of the strongest and most cunning. Therefore, so long as competition continues to be the ruling factor in our industrial system, the highest development of the individual cannot be reached, the loftiest aims of humanity cannot be realized. No truth can avail unless practically applied. Therefore those who seek the welfare of man must endeavor to suppress the system founded on the brute principle of competition, and put in its place another based on the nobler principle of association. But in striving to apply this nobler and wiser principle to the complex conditions of modern life, we advocate no sudden or ill-considered changes; we make no war upon individuals; we do not censure those who have accumulated immense fortunes simply by carrying to a logical end the false principle on which business is now based. The combinations, trusts, and syndicates of which the people at present complain demonstrate the practicability of our basic principle of association. We merely seek to push this principle a little further, and have all industries operated in the interest of all by the nation, — the people organized, — the organic unity of the whole people. The present industrial system proves itself wrong by the immense wrongs it produces: it proves itself absurd by the immense waste of energy and material which is admitted to be its concomitant. Against this system we raise our protest: for the abolition of the slavery it has wrought and would perpetuate, we pledge our best efforts."

— Two daring Englishmen, Mr. E. W. Everest and Count de Sainville, have started from Winnipeg on an adventurous trip. They propose to descend the Mackenzie, which is nowadays easily accomplished by means of the steamer that was put on the river a few years ago. They intend to start west from the mouth of the Mackenzie, and to follow the Arctic shores as far as Bering Strait. It appears that they intend to study the Eskimo of Cape Bathurst and Point Barrow. It is expected that the expedition will occupy two years.

— Mr. George F. Kunz sails on April 20, per steamer "La Champagne," to represent Messrs. Tiffany & Co. at the Paris Exposition, and also to be acting special agent for the United States Exposition Committee, having in charge the government mineralogical and metallurgical exhibit.

— At the instance of Mr. Jules Simon, president of the commission of the history of inventions, at the great International Exhibition at Paris, it has been decided that an important part of this branch of the exhibition shall be tableaux showing the characteristic industries of each of the great epochs of the history of mankind. This plan has been taken up vigorously, and a number of tableaux have been completed. For illustrating the industries of primitive man, four groups in full size have been made, — the first makers of stone implements, the first engravers, the first architects, and the first founder. The first group represents a man and a woman. They flake the flints in the same way as the Australians continue to do up to this day, the physical and ethnological character of whom is, moreover, so much like that of the earliest inhabitants of central and western Europe. This scene has been modelled according to a sketch by Baines. The first engravers are troglodytes of the reindeer age. One of them graves relief figures on a perforated stick of the class generally called chief's batons. The other cuts small sticks which are to become needles. The group "Founding of Bronze" shows a founder casting the metal in the mould, while another man blows up the fire by means of the double bellows which have been used since the earliest times in eastern Asia. All these figures — and this is the most noteworthy part of the work — have been modelled according to skulls and skeletons of the various races, — those of Canstadt, Cro Magnon, Furforz, etc. Dr. Hamy undertook the reconstruction of the human races of these ages, and it was found that the resulting types are pretty much of the same time as many modern Europeans. The collection, furthermore, embraces Egyptian, Chaldaean, Greek, and Gallo-Roman figures. Egypt is represented by a weaver reproduced

from a grave at Thebes. As a representative of Chaldaea, Gudea has been chosen, offering to his god a model of the temple of Tello. Four Greeks are shown engaged in making painted vases. Ancient France is represented by a factory of clay statuettes. The arts and industries of primitive people will be represented by a negro forger and a Samojede engraver; those of eastern Asia, by a Chinese potter; while a manufacturer of paper will represent the industries of ancient America. This collection of groups of working-men will be supplemented by collections of their manufactures.

— At a recent meeting of the Swedish Anthropological Society, Professor G. Storm read a paper on his researches relating to the Lapps. The speaker held, says *Nature*, that this race had settled in northern Scandinavia as far back as the stone age, and had not begun to move southwards until the middle ages. These southward movements had occurred periodically. At the end of the fifteenth century the Lapps had reached the sixty-fourth degree of latitude, but were now found much farther south. The subject was of interest, because of the general belief that the Scandinavians had driven the Lapps northwards. In common with others, Professor Storm was of the opinion that the Lapps belonged to the Finnish-Ugrian race.

— The second season of the Marine Biological Laboratory, of which Dr. C. O. Whitman is director, will open soon. In the investigators' department, Howard Ayers, Ph.D., and E. G. Gardiner Ph.D., are assistants. In the students' department, J. S. Kingsley, Sc.D., is instructor in zoölogy; James E. Humphrey, S.B., instructor in botany; and Playfair McMurrich, Ph.D., instructor in microscopical technique. In addition to the regular courses of instruction, and the appointed aids in laboratory work, occasional lectures, or informal accounts of results obtained in special lines of research carried on at the laboratory, may be expected from some of those who will occupy investigators' tables. Professor E. B. Wilson of Bryn Mawr, and Professor C. S. Minot of Harvard Medical School, will be among the number of such contributors. The new laboratory is located on the shore, at Wood's Holl, Mass., near the laboratories of the United States Fish Commission. The building consists of two stories — the lower, for the use of students receiving instruction; the upper, exclusively for investigators. The laboratory has aquaria supplied with running sea-water, boats, collecting apparatus, and dredges; it will also be supplied with alcohol and other re-agents, glassware, and a limited number of microtomes and microscopes. By the munificence of friends, the library will be provided henceforth not only with the ordinary textbooks and works of reference, but also with the more important journals of zoölogy and botany. The laboratory for investigators will be open from June 3 to Aug. 31. It will be fully equipped with aquaria, glassware, re-agents, etc., but microscopes and microtomes will not be provided. In this department there are eight private rooms for the use of investigators not requiring instruction, who are invited to carry on their researches at the laboratory. Those who require supervision in their work, or, being already prepared to begin original work, desire special suggestions and criticism, or extended instruction in technique, will occupy tables in the general laboratory for investigators, and will pay for its privileges a fee of fifty dollars. The laboratory for students will be opened on Wednesday, July 10, for regular courses of seven weeks in marine zoölogy and microscopical technique. Botany will be taught for the present season during August. Opportunities will be given for collecting and preparing material for use in the classroom and for special lines of study. The fee for workers in this department is twenty-five dollars, payable in advance. The number of students will be limited to twenty-five, and preference will be given to teachers or others already qualified. By permission of the director, students may begin their individual work as early as June 15, without extra charge, but the regular course of instruction will not begin before July 10. Applications for places in either department should be addressed to Miss A. D. Phillips, secretary, 23 Marlborough Street, Boston. The new laboratory is intended to continue and enlarge the work of the laboratory at Annisquam, carried on for six years by the Woman's Education Association, with the co-operation of the Boston Society of Natural History.

SCIENCE:

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

PUBLISHED BY

N. D. C. HODGES,

47 LAFAYETTE PLACE, NEW YORK.

SUBSCRIPTIONS.—United States and Canada.....\$3.50 a year.
Great Britain and Europe..... 4.50 a year.
Science Club-rates for the United States and Canada (in one remittance):

1	subscription 1 year	\$ 3.50
2	" 1 year	6.00
3	" 1 year	8.00
4	" 1 year	10.00

Communications will be welcomed from any quarter. Rejected manuscripts will be returned to the authors only when the requisite amount of postage accompanies the manuscript. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a guaranty of good faith. We do not hold ourselves responsible for any view or opinions expressed in the communications of our correspondents.

VOL. XIII.

NEW YORK, APRIL 19, 1889.

No. 324.

CONTENTS:

THE LOOMIS ELECTRIC-LIGHT SYSTEM..... 292	NOTES AND NEWS..... 298
AYRTON AND PERRY'S IMPROVED AND NEW AMMETERS AND VOLTMETERS..... 293	EDITORIAL..... 302
AN ELECTRIC DOOR-OPENER..... 294	Stanley's Explorations as affecting our Knowledge of Central Africa.
BUILDING-STONES OF EAST TEXAS..... 295	THE STUDY OF THE DEAF..... 302
TEXAS ASPHALTUM..... 295	THE MARINE BIOLOGICAL LABORATORY..... 303
EXPLORATION IN MEXICO..... 295	REPORT OF THE HEALTH-OFFICER OF THE PORT OF NEW YORK..... 304
HEALTH MATTERS.	BOOK-REVIEWS.
Baking-Powders..... 296	The Student's Atlas..... 305
Quarantine Conference..... 296	AMONG THE PUBLISHERS..... 305
Treatment of Obesity..... 297	LETTERS TO THE EDITOR.
ELECTRICAL NEWS.	The Robinson Anemometer..... 307
The Clark Cell as a Source of Standard Currents..... 297	H. A. Hazen
The Detroit Secondary Battery..... 297	Surveys, their Kinds and Purposes..... 307
The Magnetic Properties of Nickel..... 298	Herbert G. Ogden
A Challenge to the Westinghouse Company..... 298	English Examinations..... 309
The Conductivity of Mica at High Temperatures..... 298	Peter T. Austen

AN IMPORTANT QUESTION upon which Stanley's journey, according to his recent letter, may throw light, is the doubtful connection of the Mootan Nziye with the Aruvimi or with the Albert Nyanza. From a passing mention of this question in the letter, it would appear that Stanley inclines to the opinion that the lake belongs to the Kongo system. He states that it is far smaller than the Albert Nyanza, and this statement necessitates an important change in our maps of Central Africa. Mr. Wauters of Brussels, whose opinions regarding the hydrography of the Kongo basin deserve special consideration, has long maintained that the lake must belong to the Aruvimi system, as it would be impossible to account for the enormous amount of water carried by that river if it had its source west of the lake. Other geographers, among them A. Kirchhoff, have maintained the existence of a connection between the southern lake and the Albert Nyanza. In this case, the lake would belong to the Nile system. Undoubtedly Stanley's explorations will materially add to the solution of this interesting problem. His whole route led to entirely unknown territory, and will disclose another section of the western slope of the great East African highlands. Among the ethnographical notes contained in his letter, the discovery of a new tribe of dwarfs, called Wambutti, is noteworthy, as they add one more to the great number of these widely scattered dwarfish people which have become known recently. The Wambutti occupy an intermediate location between the Akka

of the Welle, and Batwa of the southern Kongo affluents. The natives, among whom these dwarfs live, are described as "strong, brown-bodied, with terribly sharp spears," — a description which shows that they belong to the group of the peoples inhabiting the watershed between the Welle and Nile, and not to the Bantu.

THE STUDY OF THE DEAF.

THE April number of the *American Annals of the Deaf* contains much valuable information of a general as well as of a special nature. Professor Greenberger, in speaking of the difficulty often experienced in ascertaining whether a deaf-mute is idiotic or not, narrates a number of instances in which children have been placed in idiot-asylums who afterwards proved to be quite intellectual. He says that the brightest pupil, without exception, that he has ever had under his charge was a semi-deaf boy, who, on account of his partial hearing, had been mistaken for an idiot, and placed in a school for feeble-minded children before he was sent to a deaf-mute institution. He afterwards became an able editor and part-owner of a newspaper.

W. G. Jenkins, M.A., contributes a very valuable article on diction and idiom, and points out the great difficulty which learners of the English language experience in mastering it.

"At the end of four years, the ordinary pupil is in possession of a vocabulary of three or four hundred words. His habit of composition has become pretty well fixed by that time, and his later acquisitions are but expansions of the work already begun. The skeleton has been formed, and the more meat that can be added, the more satisfactory will be the result. The first three or four hundred words in a deaf pupil's vocabulary are short, easy words; and a suggestion to discourage synonymes is nothing else than a plea that the easy Saxon words already acquired be retained, in preference to the longer Latin equivalents. If a pupil has been taught to write, 'Mr. Smith built a house,' it would be better for him, to the end of his life, to use those words, when necessary, than to write, 'Mr. Smith erected a residence.' I do not think there can be two opinions on the wisdom of urging our pupils to use such words as 'buy,' 'lead,' 'begin,' 'hate,' 'end,' 'go,' 'hide,' 'whip,' 'letter,' 'famous,' in preference to 'purchase,' 'conduct,' 'commence,' 'abominate,' 'terminate' or 'conclude,' 'proceed,' 'conceal,' 'chastise,' 'epistle,' and 'illustrious.' It is desirable that our pupils should know every word they meet, but it is not desirable to use synonymes for the language already in their possession. To encourage the use of long words for the short, easy words already familiar, would bring us under Goldsmith's criticism of Dr. Johnson, of 'making minnows talk like whales.' The boy who wrote of making shoes on a conclusion (last), and the one who fermented on his father's farm, together with the Frenchman who wrote to his English friend, praying that 'he and his family might be pickled to all eternity,' might have expressed themselves very clearly had they been less ambitious for synonymes.

"If it were only possible to find out what words were best adapted to the requirements of every-day life, and what number could be practically taught in the few years at our disposal, a valuable aid in the work of instruction would be secured. Of the one hundred and fourteen thousand words in the English language, we must make up our minds to dispense with all but a thousand when we consider the written language of the deaf. The mastery, indeed, of five hundred words would be a most gratifying accomplishment. It is claimed, by no less an authority than Max Müller, that a well-educated English scholar, a representative of the best university, one who is familiar with Shakspeare and Milton, does not use more than three to four thousand words. The Hebrew Testament says all that it has to say in 5,642 words, while an English author says that in his parish the rural laborers have not more than three hundred words. However much we may mourn over it, the fact remains, that, if our pupils are to express themselves in grammatical language, we must be content with a limited vocabulary; and it is much to be feared that time spent in technical studies, in memorizing technical phraseology, is so much time taken away from practice in the language of the common people."

A. L. E. Crouter, M.A., contributes an article on the proper lo-

cation of an institution for the deaf, style of buildings, and best methods of lighting, heating, and draining. Among miscellaneous matter treated in the *Annals* we notice two reported cases of so-called cures of deafness by the "faith-cure" and "Christian science." One of these was a boy living in Japan, who was said to have had his hearing restored by the prayer of missionaries. This case was investigated by a trustworthy gentleman living in Tokio, where the case occurred. He writes: "The only foundation for the story of his cure by prayer was that at the time of the effort made in his behalf he seemed, or was imagined by those who so eagerly watched him, to hear the sound of the school-bell. I judge, from all I can gather, that there is nothing in the case which the intent watching of those interested will not readily account for."

The *Oregon Sign* remarks as follows on a reported restoration to hearing of a former pupil of the Oregon School by "mind-cure" or "Christian science": "A Portland daily paper of a recent date names among others Miss Mary Lance, a deaf-mute young lady long a pupil in this school, as having her hearing partly 'restored' by nine 'treatments' by a 'mind-cure,' or so-called 'Christian science,' doctor. Miss Lance writes to friends here that she is as deaf as ever, and expects to return to school. There is, no doubt, science that is Christian, and Christianity that is science; but there is a great deal in the world that is neither science nor Christianity, for quackery has nothing to do with either. Newspapers do a great injury when they publish such nonsense, as deaf children are often kept out of school by a false hope that they may be cured."

THE MARINE BIOLOGICAL LABORATORY.

FROM Liebig's "*Welt im Glase*" arose the idea of public marine aquaria, first developed in London, then in many other cities on the Continent. The institution became popular, not only as a means of amusing and instructing the general public, but as an invaluable source of instruction for schools and universities. The hope was entertained for a time that such inland aquaria could be made useful to scientific men for the study of marine life. It soon became evident, however, that such study could be successfully prosecuted only at the seashore. The marine laboratory, with its aquarium, followed. The idea of maintaining marine stations for scientific work was first acted upon by Carl Vogt in Europe, and by Louis Agassiz in America; while one of the earliest, and by far the most successful, undertakings of this kind that the world has yet seen, is represented in the Naples Station, founded and directed by Anton Dohrn. The history of that institution has been often repeated, and is doubtless familiar, in all its essential features, to most of our readers. It is enough to say that it is an example of just what we have long needed in America.

"But what are the special attractions of marine life, that naturalists should so eagerly seek the seashore?" is a question sometimes asked. To this we may reply, that the ocean is the home of the lowest as well as the oldest forms of life, and it is in such forms that the mysteries of life can presumably be most nearly approached. Then there are abundance and variety, and certain important groups that do not occur in fresh water. To the luxuriance of the fauna and flora of the shore, is added that vagrant, pelagic life which is collected by ocean-currents, tides, and winds, and laid at one's feet as freely as if all nature pleaded for investigation. Moreover, the study of marine life has long been inadequately provided for, its advantages not having been generally recognized until within the last fifteen or twenty years. The comparative newness of the field, its infinite richness, and its importance in determining the origin, history, and relationships of living forms, account for the intense interest recently awakened in marine laboratories.

The new laboratory at Wood's Holl is nothing more than a first step towards the establishment of an ideal biological station, organized on a basis broad enough to represent all important features of the several types of laboratories hitherto known in Europe and America. It should be provided eventually with means for sending men to different points of the coast to undertake the investigation of subjects of special interest, thus adding to the advantages of a fixed station those of an itinerant laboratory.

The Marine Biological Laboratory is an outgrowth of a seaside laboratory maintained at Annisquam, Mass., from 1880 to 1886, by the Woman's Education Association of Boston, in co-operation with the Boston Society of Natural History. In 1886, efforts were made by the association to place the laboratory on an independent and broader foundation. A circular letter was addressed to many of the leading biologists of the country, reciting what had been already done at Annisquam, and asking for co-operation and counsel. The replies received were most encouraging, testifying to a general and hearty approval of the enterprise, and promising co-operation and support.

Accordingly, invitations were issued, and a preliminary meeting was held on March 5, 1887, in the library of the Boston Society of Natural History. Numerous addresses were made, and a committee was appointed to perfect plans for the organization of a permanent seaside laboratory, to elect trustees, and to devise ways and means for collecting the necessary funds.

The funds having at length reached such an amount as was deemed adequate to a modest beginning, the necessary steps were taken; and in March, 1888, the laboratory was incorporated under the name of the Marine Biological Laboratory, and the following were chosen officers of the corporation: trustees, William G. Farlow, Edward G. Gardiner, Alpheus Hyatt, Susan Minns, Charles S. Minot, William T. Sedgwick, Samuel Wells; treasurer, William Stanford Stevens; clerk, Anna D. Phillips. The trustees immediately organized, and elected Professor Alpheus Hyatt president, and Miss A. D. Phillips, secretary. Professor Farlow soon after resigned, and Professor E. L. Mark was chosen as his successor. Dr. Gardiner, who had kindly consented to enter the board to fill a temporary vacancy, also soon withdrew, and Miss Florence M. Cushing was chosen in his stead.

The trustees, who had already, through a committee, instituted thorough inquiries as to the best place for the laboratory, now set themselves actively to work to locate it, to build and equip it, and to make the necessary plans for the summer's work. Although the time was unduly short, and differences of opinion as to location, policy, etc., difficult to reconcile, had to be harmonized, it was still deemed wise to make a beginning at once, and, if possible, to open the laboratory in 1888. Accordingly, after prolonged and careful consideration, a piece of land (78 × 120 feet) was purchased at Wood's Holl, Mass., close to the shore, and near the buildings of the United States Fish Commission. A plain but very substantial building, 63 × 28 feet, and two stories high, was erected, and was completed within the specified time and at the estimated cost. It was equipped with unusual thoroughness, and was finally opened for work on the day appointed; viz., July 17, 1888.

Dr. C. O. Whitman had already been appointed director of the laboratory, and Mr. B. H. Van Vleck, instructor. Two circulars were issued in June, much later than could have been desired, announcing the opening of the laboratory, and stating the facilities to be provided for investigators and students. One was addressed chiefly to teachers and other workers; the other, to colleges likely to be specially interested. It was so late, however, before it was deemed safe to issue them, that no great response was looked for, or, in fact, occurred.

On the opening day, a small company of students, investigators, and invited guests were present, and the laboratory was formally opened with an address by the director (see *Science*, xii. p. 37). Somewhat earlier than this, Mr. Joseph S. Fay had signified to the trustees his willingness to place at their disposal for the season, a small house on the main street of Wood's Holl, known as "Gardiner Cottage." This gift was most timely, as it enabled the trustees to establish headquarters for the board and lodging of those connected with the laboratory, and contributed directly to its attractiveness and success, as well as to the comfort and welfare of the students.

Owing to the uncertainty connected with the finishing and equipping of the laboratory, it was not possible to issue public circulars until many colleges had disbanded for the summer, and students generally had formed other plans. Nevertheless, during the season there were connected with the laboratory eight students and seven investigators.

The laboratory has now made a beginning. It has secured a

solid foundation and a sound working organization. On what has thus far been done there is every reason for congratulation. This is, however, but the mere beginning of what there should be. More room will soon be needed, more and better boats. A special landing-place must shortly be purchased. An increased equipment of microscopes and aquaria will certainly have to be provided. A working library of good size and quality, placed in the laboratory itself, is absolutely indispensable. The indications point to a large influx of investigators and students, and the trustees foresee the possibility of more applicants than they can accommodate. To meet these new needs and emergencies, more funds are urgently demanded; and the trustees earnestly appeal to the corporation, and to the supporters of science everywhere, for sympathy and active support, so that they shall be enabled to carry on aggressively a work already begun, and proven not only possible but worthy.

REPORT OF THE HEALTH-OFFICER OF THE PORT OF NEW YORK.

THE annual report of the health-officer of the port of New York, Dr. William M. Smith, to the Board of Commissioners of Quarantine, contains much valuable statistical and other material. During the year 1888, 5,291 vessels arrived at New York from foreign ports, and 1,053 from domestic ports, which are subject to quarantine regulations. As compared with 1887, the number from foreign ports was less by 637. Dr. Smith states that the arrivals are diminishing each year, and gives figures to sustain this statement. The number of steerage passengers inspected by the medical officers of the department was 383,595, arriving by more than twenty different lines of vessels; the North German Lloyds bringing the largest number, 52,926. In speaking of this subject of immigration, Dr. Smith says: "There are few subjects of greater importance for the consideration of maritime quarantine officials, and of our municipal health authorities, than the immense immigration which has been flooding our country for the past nine years, and which there is reason to believe will continue for years to come. The same political and economic conditions which existed in 1879, when the immigration from the Old World increased from 135,020 in that year, to 327,371 in the year following, have continued to this time, and bid fair to obtain for years to come. Our vast unsettled area of country is likely to continue to invite, and the inexhaustible resources of our mines and forests will stimulate, an exodus of the surplus population of Europe for a long period in the future. Under these circumstances, it is the duty of health authorities to adopt such measures at ports of entry for immigrants as will contribute to land them upon our shores in such physical condition that they will add to the material prosperity of the country, instead of taxing its resources and increasing its burdens. Those who derive a profit from the transportation of immigrants, as well as those who come to share the blessings which our country affords, are under obligations to supply all the means and to take all the precautions necessary to secure the health of immigrants, and protect our communities from the diseases, developed or latent, with which they too frequently come hand in hand. Improper or insufficient food, imperfectly ventilated and overcrowded steerages during the voyage, are far too frequent. During the early part of the year 1888, the steamer 'Comorin' arrived with 1,263 immigrants; the 'Cachemere,' with 1,411; the 'Bohemia,' 1,280; 'Chateau Yquem,' 1,228; 'Alesia,' 1,018; and the 'Cashar,' with 1,520. These poor people were crowded between decks most of the time for two weeks, and some for twenty days. During the cholera epidemic in 1887, among the passengers of the 'Alesia' there was a larger percentage of deaths among those taken sick during the voyage than among those who suffered from the disease while in quarantine. While the passengers of the steamer 'Britannia' were detained at quarantine the same year on account of cholera, an epidemic of measles developed among them. The symptoms in most cases were more severe, and the fatality much greater, than is usual in that disease, the percentage of fatal cases being something more than fifteen per cent. There is no cause of death given so frequently by the surgeons of immigrant passenger-steamers as *marasmus*. The diagnosis should be

starvation. The victim is always a child at the breast. The mother, prostrated by seasickness, her vitality depressed by the crowd-poisoned air of the steerage, and exhausted for want of proper food, is unable to supply the child with sufficient nourishment. The immigrant mother often ceases entirely, for the time being, to afford her infant its accustomed food. The child is then given the only substitute, the coarse fare of the adult immigrant: indigestion, diarrhoea, and death are often the result."

In speaking of contagious diseases among immigrants, Dr. Smith says that small-pox continues to be one of the most frequent, and is by far the most difficult, latent contagion to arrest by maritime quarantines. The incubative period of the disease being fourteen days, and the average passage of steamers from ports of Europe and the British Isles several days less than that time, the disease may be contracted at the port of departure, or in the interior of Europe, and not develop until the immigrant reaches some far interior community in this country. To prevent or limit to a possible minimum the importation of this contagion has enlisted more earnest effort, and has been productive of more anxious reflection on the part of the health-officers, than any other subject during the past nine years. He recommends that all persons who have not been vaccinated within six or eight years should be vaccinated within the first two days after they go on board ship.

The history of the yellow-fever which occurred on the United States Cruiser "Boston" and the United States sloop-of-war "Yantic" is given in considerable detail. In discussing the origin of the fever on these vessels, Dr. Smith says that neither the "Boston" nor the "Yantic" received anything on board from the shore, while at Port au Prince, except meat and fruit. The fruit, consisting of bananas and oranges, was taken to the vessels by natives in what is called "bumboats," and sold to those on board. The main decks of the "Boston" and "Yantic" are so low, that communication between those on them and the "bumboats" was easy, and doubtless frequent, while the natives were vending their fruit. The wet, dirty, and sun-heated bottoms and timbers of the boats of the natives, exposed, as they must be at all times when at the shores or wharves, to an infected atmosphere as well as to the infected filth of the gutters that drain into the bay, certainly supply all the conditions necessary for the propagation of the infection. It would be rather a matter of surprise than otherwise, if the boats of the natives were not impregnated with the infection of yellow-fever when it prevails at Port au Prince. The history of the disease on the "Boston" and the "Yantic" affords satisfactory evidence to Dr. Smith that the persons who suffered from it contracted the infection while at Port au Prince, and that the infection did not infect either vessel; in other words, that the infection was limited to the individuals who contracted the infection at that port.

Dr. Smith refers to the disappearance of cholera from Europe and America. The confident prediction, he says, has not been fulfilled, which was frequently made by wiseacres during the winter of 1887-88 and until the spring of 1888 was well advanced, in reference to the cholera infection among the passengers of the "Alesia" and "Britannia" in the fall of 1887; to wit, that the germs of the disease had escaped with the baggage when the immigrants were released from quarantine, and would be propagated the ensuing summer until the disease developed into epidemic proportions. The history of this terrible disease since its first advent in Europe in 1829-30 warranted the suspicion that its arrival at our quarantine was the forerunner and herald of a disastrous epidemic of cholera throughout our country. There are but few instances in the history of this disease in which it has not become epidemic in a country soon after it appeared at its threshold. He gives the following interesting history of the cholera during recent years:—

"In 1882 cholera commenced its deadly march from its home in the Ganges. Its first attack was upon Aden on the Red Sea. Early in 1883 it appeared at Damietta in Egypt, and in June of that year reached Cairo, and subsequently extended to most of the cities and towns of Lower Egypt. Those familiar with the history of cholera then confidently predicted its speedy advent in Europe. These predictions were fulfilled early in the ensuing summer. The first victims of the disease in Europe were at Toulon in the early part of June, 1884. It reached Marseilles the 28th of the same

month, and in a few weeks decimated all the towns in the south of France. Although the Italian authorities on the boundaries between France and Switzerland attempted to stay the progress of the epidemic by imposing the most rigid system of quarantine of all persons and things from infected localities, the disease had passed all sanitary cordons before the end of August, and was numbering its victims daily by hundreds in various parts of Italy. Despite every effort of the health authorities, it crossed the Pyrenees early in 1855, and began the work of destruction in Spain. Before the close of the year it had counted more than a hundred thousand victims in that country. The year following (1886), a passenger-steamer with Italian immigrants landed the pestilence at Rosario, in South America. The *cordon sanitaire* established in the passes of the Andes by the States of the west coast of South America did not prevent the disease from reaching and ravaging many of the great cities and towns on the western coast. Sept. 23, 1887, and again in the month following, cholera sought to invade our country through Italian immigrants, as it had done in South America the year previous. The story of its advent, arrest, and destruction at quarantine, has been told in my report for 1887. In the five previous invasions of Europe by this disease during the present century, it had succeeded in every instance in reaching our shores, and developing into epidemic proportions. The failure of the pestilence to secure a foothold in our country last year was a triumph, but under difficulties such as the quarantine officials at this port, it is hoped, may not again be called upon to encounter."

Extensive repairs and improvements are now in progress at the quarantine establishment, which will, in the opinion of the health-officer, supply all the conditions necessary to secure the country from any possibility of an epidemic of infectious or contagious disease which may approach from the sea. For this purpose the Legislature has appropriated \$121,843. The disinfecting-rooms are thus described. The disinfecting-rooms are divided into three airtight compartments, with sides and ceilings made of four-inch oak plank covered with felt and galvanized iron, with doors and levers to each compartment; the outer walls of brick being built hollow so as to retain the heat. The floors are concrete and asphalt, on iron beams and masonry arches. The size of the disinfecting-rooms are two 14 by 19 feet, and one 12 by 19 feet, each 7 feet high. Each disinfecting compartment will be supplied with wire baskets supported on rollers, large enough to hold one immigrant's baggage, arranged in tiers with sufficient interspace to insure the admission of hot or moist steam with the least possible obstruction. The arrangement contemplates the use of moist steam for a few moments before the introduction of superheated steam. The introduction of moist steam first will secure the destruction of the disease germs by superheated steam more certainly and at less temperature, and thereby lessen the danger of injury of the fabrics exposed to a high temperature. In the boiler-room underneath will be placed exhaust-pumps with separate connections to each room, that the air can be exhausted; so that the articles to be treated may be easily penetrated by the moist steam, as well as other chemicals that may be used in the disinfecting process. The rooms, after being used, will be ventilated into a shaft surrounding the boiler-flue. The superheater will be located under the disinfecting-room, with all the necessary apparatus outside of the rooms, showing pressure and temperature.

In 1887 Dr. Smith recommended that a crematory be erected on Swinburne Island, for the cremation of those who die of contagious disease. This was deemed advisable on account of the unfavorable location of the burial-ground at Seguin's Point, near the extreme southern portions of Staten Island, and ten miles from the hospital. Twenty thousand dollars has been appropriated for the purpose, and the quarantine commissioners have been empowered to cause to be incinerated in such crematory the bodies of persons dying at the quarantine hospital from contagious or infectious diseases; provided, however, that "they shall not incinerate the bodies of any persons, dying as aforesaid, whose religious views as communicated by them while living, or by their friends within twenty-four hours after their decease, are opposed to cremation."

THE Eiffel Tower has now attained its full height of 984 feet.

BOOK-REVIEWS.

The Student's Atlas. By RICHARD A. PROCTOR. London and New York, Longmans, Green, & Co. 8°. \$1.50.

THE object of the present atlas is not to convey detailed information on the geographical conditions of limited areas, but to teach the relations between continents and oceans, — an important part of geography-teaching, which has hitherto been sadly neglected. The author says in his introduction, "In studying the geography of the earth as a whole, in considering the larger problems of geology, in reading history ancient and modern, in discussing problems relating to trade and commerce, and in dealing with many other subjects of inquiry, occasion constantly arises for the means of recognizing clearly and readily the relations of the different parts of the earth to each other. An ordinary atlas shows us Europe and it shows us North America, but it presents the two continents on different scales, and, except in the imperfect maps of the two hemispheres or the still more misleading Mercator's charts, it does not show how the two continents are situated with regard to each other. Of the Atlantic Ocean, which is almost as important and interesting a region of our earth as any continent, the ordinary atlas gives no map at all. Any one who wishes to note the nature and relative directions of the tracks across the Atlantic between different parts of the surrounding shores can learn nothing from an ordinary atlas except what is false and misleading. It is the same with all the oceans." For such reasons, which cannot be remedied in an ordinary atlas, the author considers it desirable to have a companion atlas, treating the earth as a whole. The plan the author has pursued is to divide the earth's surface on the twelve faces of a dodecahedron, each map being made to include the spherical surface circumscribing the pentagonal face of the dodecahedron. Thus each map embraces a little more than one-tenth of the earth's surface, and overlaps with the five neighboring maps, thus giving a good understanding of the relative position of the parts of the earth's surface. The projection chosen is Postel's equidistant projection, the centre of each pentagon being taken as the centre of the projection. This results in comparatively small distortion of scale and angle. The maps are well executed; the political divisions are designated by different colors. The topography is very sketchy. The course of ocean-currents is indicated,

AMONG THE PUBLISHERS.

THE Century Company have just completed their monumental work on the "Battles and Leaders of the Civil War." An index to the four volumes is appended to the thirty-second and final part. In concluding this handsome and valuable work, the publishers may justly feel proud of the achievement.

— C. W. Bardeen, Syracuse, N.Y., will publish May 15 an interesting historical guide-book entitled "Carleton Island in the Revolution: the Old Fort and its Builders," with notes and brief biographical sketches, and illustrations by Carleton.

— Belford, Clarke, & Co. will publish shortly William H. Herndon's "Life of Abraham Lincoln." Mr. Herndon was for some years the law-partner of Abraham Lincoln, and knew him perhaps as intimately as any person apart from his immediate family.

— The M. L. Holbrook Company have just ready "Studies of the Outlying Fields of Psychic Science," a work by Hudson Tuttle, who aims to explain the vast array of facts in his field of research by referring them to a common cause, and furnishes nearly fifty pages of "personal experience and intelligence from the sphere of light."

— People who are interested in the prohibitory amendment which is now before the State of Massachusetts for popular vote, will find a concise statement of the entire legislation in recent years in "Ten Years of Massachusetts," by Raymond L. Bridgman, published by D. C. Heath & Co. of Boston. It includes the years 1878 to 1887; and among other important enactments of that period, are the civil damage law, the screen law, the schoolhouse law, and the temperance text-books law. Every new effort of the State to repress liquor-selling is mentioned, and the text of the most important passages is given *verbatim*.

—Harper & Brothers have just ready "Further Reminiscences," a second volume of "My Autobiography and Reminiscences," by W. P. Frith, the distinguished Royal academician. The interest of the new volume upholds the reputation gained by the first. One chapter contains letters and recollections of Charles Dickens; another recalls Sir Edwin Landseer; still another, devoted to Mrs. Maxwell, whom novel-readers perhaps know better as Miss M. E. Braddon, tells, among other things, about the plan she proposed to Mr. Frith for a pictorial dramatic series on the lines of Hogarth, and how the artist shrank from the painfulness of the "terrible tragedy" which she outlined. Du Maurier and John Tenniel, the famous *Punch* artists, figure in a chapter on "Book Illustrators;" and a host of other familiar names appear elsewhere, such as Robert Browning, John Ruskin, Thomas Hardy, Mrs. Lynn Linton, F. Anstey, and Anthony Trollope. They have also just ready the third edition, revised and enlarged, of C. K. Adams's "Manual of Historical Literature;" "The Mouse-Trap and Other Farces," by W. D. Howells, including among the other farces, "The Garroters," "Five O'clock Tea," and "A Likely Story," all of which, as well as "The Mouse-Trap," C. S. Reinhart has illustrated. Another book just ready is "The Tramp at Home" (illustrated), by Lee Meriwether, special agent of the Bureau of Labor Statistics at Washington, and author of "A Tramp Trip." The book contains an account of the incidents, amusing and otherwise, which befell him in the course of his study into the condition of the American working classes. Adventure, novel experience, and humorous episode are combined with original and striking testimony bearing upon social problems in the United States.

—We take the following items from *The Publishers' Weekly*: M. Taine's health has sufficiently improved to permit him to resume his literary work, and it is said that a series of three articles by him, on "The Reconstruction of France in 1800," will appear

at once in the *Revue des Deux Mondes*. F. Marion Crawford is writing a book on Sir John Hawkwood for the English Men of Action Series. Mr. Walter Besant will prepare the volume on Capt. Cook; Mr. Clark Russell, that on Dampier; and Mr. Archibald Forbes, that on Havelock. Andrew D. Mellick, jun., Plainfield, N.J., has in preparation a work to be entitled "The Story of an Old Farm, or, Life in New Jersey in the 18th Century," a semi-social, semi-historical study. The author intends to describe quite fully early German immigration to the American colonies, to vindicate the Hessian troops, and to do justice to the New Jersey Loyalists.

—Mr. Thomas S. Townsend of New York City has been at work since the beginning of the civil war, collecting, sifting, and classifying material, some of which he has now formed into a volume to be called "The Honors of the Empire State in the War of the Rebellion," and to which he calls attention. It will be issued through the Putnams as a subscription-book as soon as sufficient orders have been received to pay the cost of a first edition. Such orders should be sent to Mr. Samuel O. Fields, Library of Columbia College. On Decoration Day some years back, Mr. Townsend delivered an address before the Long Island Historical Society, which contained the germ he has brought to fruit in this volume.

—T. Y. Crowell & Co. will publish at once Bourrienne's "Memoirs of Napoleon Bonaparte," edited by Col. R. W. Phipps of the Royal Artillery. The edition is in four volumes, and is a reproduction of the latest English edition, containing all the notes, portraits, medallions, maps, etc., with the addition of several facsimile autographs and a full index. They will publish shortly "A Popular History of the French Revolution," by Mrs. Lydia Hoyt Farmer, which is based on the latest French and English authorities.

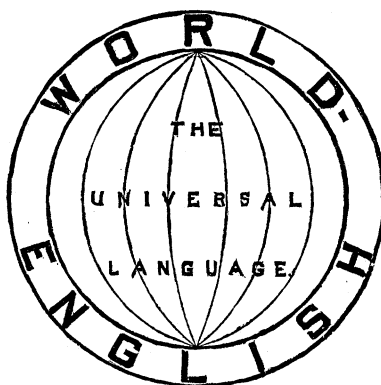
ONE LANGUAGE FOR THE WHOLE WORLD.

WORLD-ENGLISH:

THE UNIVERSAL LANGUAGE. 25 CENTS.

EVERY one has heard of the butcher who, after a long search for his knife, at last found it in his mouth; so speakers of English have been seeking for a universal language, when, lo! it is in their mouths. The intelligibility of English words has been obscured by a dense mist of letters. This is now dispersed by A. Melville Bell, who has already won a world-wide reputation through his invention of "Visible Speech," the great boon to deaf-mutes. Professor Bell calls this new discovery of his "World-English," and the result is a language which cannot fail to meet with acceptance, and at once supersede the supposed necessity for "Volapük," or any other artificial language. No language could be invented for international use that would surpass English in grammatical simplicity, and in general fitness to become the tongue of the world. It is already the mother-tongue of increasing millions in both hemispheres, and some knowledge of the language is demanded by all educated populations on the globe. Social and commercial necessities require that the acquisition of this knowledge shall be facilitated, and it is believed that Professor Bell's invention has removed the last impediment to English becoming the universal language, for which vague desires have long been entertained, although hitherto only futile efforts have been made.

Ex-President Andrew D. White, of Cornell University, says: "I believe that the highest interests of Christian civilization and of humanity would be served by its adoption. China and Japan would be made English-speaking peoples within fifty years, and so brought within the range of Christianizing and civilizing ideas, in the largest sense. All existing missionary work is trivial as compared with this. For your system would throw wide open those vast countries, as, indeed, all the countries of the world, to the whole current of English and American thought."



For Diffusion of English throughout the World

AS
THE UNIVERSAL LANGUAGE

This "Hand-Book of World-English" is the Complete, Simple, and Efficient Medium.

FOREIGNERS

Will Acquire, by Means of this Hand-Book, a
PERFECT PRONUNCIATION OF ENGLISH.

For Primary School Pupils and Illiterate Adults

World-English is a Royal Road to Reading.

To Teachers of English and Modern Languages

This Hand-Book will be of Primary Importance
as a Phonetic Directory.

DEFECTS OF SPEECH

Will be Readily Corrected by Means of the Articulative Directives in this Hand-Book.

HAND-BOOK OF WORLD-ENGLISH,

25 CENTS.

The plan of this little book is altogether new. Letters and sounds are so associated, in all the exercises, that from the mere knowledge of letters a learner cannot fail to pronounce words with certainty. English reading will thus be easily acquired, whether by natives or foreigners, children or adults.

The general resemblance of World-English to Literary English is such that any reader of the latter deciphers the former at sight, or, at most, after a few minutes' study of the new letters. A like result may be anticipated for those who shall learn to read from World-English. They will transfer their power of reading to the literary form of the language, almost without effort. The orthographic aspect of words will, besides, be so fixed in the eye, by contrast, that spelling will be remembered as — what it really is — a pictorial association with words.

No special training is required to qualify teachers for using this book. The subject can even be successfully introduced in the kindergarten and the nursery. This phonetic mode of initiation in reading cannot be too strongly urged on the attention of School Boards on both sides of the Atlantic.

The ordinary orthography of each word is interlined with the World-English version throughout the Exercises and Readings.

So set down, our tongue is the best for the world to unite upon.—*Brooklyn Eagle*.

The idea of Mr. Bell has much to recommend it, and the presentation is charmingly clear.—*American*, Phila.

The result is a language which cannot fail to meet with acceptance.—*Boston Traveller*.

Has the merit of great ingenuity.—*Railway Age*.

His treatise, as a study of English orthoepy, condenses the result of much thought and experience in small compass.—*The Critic*.

World-English deserves the careful consideration of all serious scholars.—*Modern Language Notes*.

World-English is the English language unburdened of its chaotic spelling.—*Popular Science Monthly*.

We commend it to the attention of teachers.—*Ottawa Globe*.

"World-English" and "Hand-Book of World-English" can be had of all booksellers, or will be sent for 50 cents, post free, by the publisher,

N. D. C. HODGES, 47 Lafayette Place, New York.

— Scribner & Welford have just imported a unique example of book-making in the "Mulum in Parvo Atlas of the World." It contains ninety-six double-page maps, a large amount of statistics, and an index covering over one hundred pages, all in shape and size for the pocket. They have just ready a volume of poems and translations by W. J. Linton, the well-known engraver. He privately published, before this, two volumes of poems, both in very limited editions, and now very scarce. In this volume nearly all the poems in those two volumes are included; and, besides new poems, a number of new renderings of French poems, in the original metres, are included.

— Roberts Brothers announce for early publication the second volume of Renan's "History of the People of Israel," covering the period from the reign of David to the capture of Samaria, 721 B.C.; and "French and English," a comparison between these great nations in literature, science, and art, by Philip Gilbert Hamerton.

— Macmillan & Co. will act as the American agents of Sonnenschein & Co.'s new Library of Philosophy. This library is to consist of a series of works edited by J. H. Muirhead, and arranged in three departments, dealing respectively with schools of philosophers, the history of thought in particular departments, and the subject-matter of philosophy treated from an original point of view. In the first series, which will, it is expected, ultimately cover the entire history of thought in the fields of metaphysics and ethics, the following volumes have already been promised: "Sensationalists: Locke to Mill," by W. S. Hough of Ann Arbor, Mich.; "Modern Realists: Leibnitz to Lotze," by Professor Andrew Seth of St Andrew's; "Early Idealists: Descartes to Leibnitz," by W. L. Courtney of New College, Oxford; "Scientific Evolutionists: Comte to Spencer," by Professor John Watson of Kingston, Canada; "Utilitarians: Bentham to Contemporary Writers," by W. R. Sorley of Trinity College, Cambridge; "Moral Sense Writers: Shaftesbury to Martineau," by Professor William Knight of St. Andrew's; and "Idealistic Moralists: Kant to Green," by Professor Henry Jones of University College, Bangor, Me. Of the volumes of the second series, already arranged for, may be mentioned a "History of Logic," by Professor George S. Morris of Ann Arbor, Mich.; "History of Psychology," by Professor Adamson of Owens College; "History of Political Philosophy," by D. G. Ritchie and J. H. Muirhead; "History of Economics," by Dr. J. Bonar; "History of Æsthetics," by A. Bosanquet; and "Evolution of Theology," by Professor Otto Pfeiderer. As an introduction to the library, Erdmann's (smaller) "History of Philosophy," in three volumes, has been translated by Dr. W. S. Hough of Ann Arbor, Mich., and will appear very shortly.

— Macmillan & Co. have just ready F. Marion Crawford's latest novel, "Greifenstein," the scene of which is laid in South Germany, principally in the Black Forest. Some charming bits of German university life are given.

— D. Appleton & Co. have just ready "The History of Ancient Civilization," a handbook based upon M. Gustave Ducoudray's "Histoire Sommaire de la Civilization," a recent French work that has been highly commended by European critics, edited, revised, and extended by Rem. J. Verschoyle. The second part of the work, treating of modern civilization, will appear shortly. They have also just ready "The Ladies' Gallery," by Justin McCarthy and Mrs. Campbell-Praed, in their Town and Country Library.

— Almost the only new English poet who has won a way into American magazines in the past two or three years is Mrs. Graham R. Tomson, a collection of whose verse is about to be issued by Longmans, Green, & Co., almost at the same time that they publish Col. Higginson's poems. Mrs. Tomson's book is called "The Bird-Bride, a Volume of Ballads and Sonnets." The title "ballad" is of interest to Americans, in that it is an Eskimo legend.

— In the May issue of *The Chautauquan*, Professor J. A. Harrison of Washington and Lee University discusses "Physical Culture in Ancient Greece;" Thomas D. Seymour of Yale University writes on "Demosthenes," the eighth in the series of Greek biographical sketches; Russell Sturgis has a paper on "The Archæ-

ologist in Greece;" the Rev. J. G. Wood, the eminent English naturalist, gives the first of a two-part paper on "Odd Fishes;" Charles Barnard writes of "The Social and Economic Effects of Railroads;" Helen Campbell discusses "The Child and the Community;" "Internal Improvements" is the subject of an article by Franklin H. Giddings of Bryn Mawr College; John Burroughs writes on "Lovers of Nature;" Professor Charles J. Little of Syracuse University considers "The Paris Mob and its Achievements;" an article on "Queer Uses of Words" is from the pen of Rebecca Hart; a sketch of the Russian general, Loris-Melikof, is translated from the *Revue des Deux Mondes*; Dr. H. C. Adams of Michigan University explains the nature and use of "National Bank Notes;" and Charles Frederick Holder closes the list of contributed articles with an account of "The Early Californians."

LETTERS TO THE EDITOR.

*.*Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

The editor will be glad to publish any queries consonant with the character of the journal.

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The Robinson Anemometer.

IN concluding my share in the discussion of this question, I wish to show that it looks now as though Professor Marvin and I have been considering the same resultant effect in the anemometer problem, but from different standpoints. If we place an anemometer on a whirler in a free wind, it is easy to see that the wind must have, relatively, a constant effect in all portions of the rotation. If the wind is double the velocity of the whirler, the resultant effect will be due two-thirds to it and one-third to the whirler; if the two are equal, each will produce half the effect; and so on. This effect has an actual continued increase during half a rotation, and an equivalent diminution during the remaining half: therefore it seems plain that the momentum acquired by the cups during half the rotation of the whirler would be balanced by that lost during the other half.

Viewed from the standpoint of the free wind effect, however, we see an entirely different condition. In computing the anemometer factor, it has been customary to regard the motion of the whirler as entering in its entirety in every rotation, and the whole resultant effect of both whirler and wind on the anemometer has been combined with that. In consequence the total effect differs with each relative motion of whirler and wind. For example: if the wind is double the whirler velocity, there is an increase above the motion due to the whirler during the whole of its rotation, and a total increase in the effect, due to the wind, of about 100 per cent; if the two are equal, there is an increase for two-thirds of the whirler rotation, with an increase of over 25 per cent in the effect due to the wind; if the wind is half the whirler, the increase continues through about 59 per cent of the rotation, with an increase in the resultant of 10 per cent; and so on. If we add to this the effect of whirls in the air, the low results found in England seem to be accounted for.

It seems to be pretty well proved that heavy cups, from their momentum, do not run ahead of lighter cups in an intermittent wind; and even if they did, their resultant motion would not be increased on a whirler. There is good evidence, that, at least at a low velocity of the whirler, the direct effect of the free wind accounts for the very low anemometer factor found therein.

H. A. HAZEN,

Washington, D.C., April 15.

Surveys, their Kinds and Purposes.

WILL you kindly permit me space to criticise some of the conclusions reached by Mr. Marcus Baker, in the paper on "Surveys, their Kinds and Purposes," published in your issue of Nov. 30, 1888? The classification of surveying work is becoming more important every day, in view of the greater interest the States are

taking in the preparation of working maps of their territories, and the extensive surveys that have been authorized by the general government. Any thing, therefore, that will tend to bring about a better understanding of general terms should be hailed as a step in the right direction. Mr. Baker presents one view of the subject in a forcible manner, but it seems to me far from satisfactory.

The title of the paper fairly justifies the impression that the author intended to classify surveys which result from the practical application of the science and art of surveying; and, indeed, the subjects enumerated in the second and third of his "great divisions" bear out the inference. In the "first division," however, which includes all surveys for general purposes in its broad scope, he fails to mention many kinds which he might include, unless he is willing to restrict the word "survey" to work related to what the Germans would call *Vermessungs Kunde*. Why include geological and agricultural surveys, and omit statistical, ornithological, and botanical surveys, not to mention many others?

The geologist doubtless needs maps on which to exhibit some of the results of his geological explorations, but the science of geology and that of surveying can hardly be related by merely putting the words in juxtaposition. It must ever remain a thankless task to classify heterogeneous subjects whose kinship is due merely to the use of the word "survey" in a metaphorical or general sense, rather than in the precise and technical one in which it is used when applied to the second and third divisions.

But Mr. Baker does not uphold the classification he has offered any further than to maintain that it will answer his purpose quite as well as many others that could be made; and we might therefore let it pass had he not advanced a principle for its construction that would tend to endless difficulties should it be universally adopted.

That "surveys must be of various kinds, because they are made to serve various purposes: a classification of kinds is, then, a classification by purposes,"—I believe to be a fundamental error. Nor is it strengthened by the grouping into three great divisions,— "information," "boundary," and "improvement" surveys; or, as he expresses their equivalents, "general," "jurisdictional," and "construction" purposes; or the subsequent definition that "the general study of the earth is the object and purpose of information surveys." Strictly speaking, all surveys are for information, and therefore the three great divisions could with propriety be consolidated into one. It is only through the definition, "the study of the earth," that the "divisions" are plausible. Admit that a survey may be useful for many purposes, and they are no longer tenable. There are but few surveys of mensuration that have been instituted primarily for the purpose of acquiring information for "the study of the earth," while all contribute to this end. For many years past, since the art of surveying has been recognized as a science, surveys have been classed under designations that seem to me to admit of little improvement,—from "geodesy" we have "geodetic" (measurement of the earth); from "topography," "topographic" (measurement of the land areas); and from "hydrography," "hydrographic" (the water areas). All surveys of mensuration are included in these three, either directly or in combination with one another. A geodetic survey has a single purpose primarily, but it may also be the basis for all other surveys. Topographic and hydrographic surveys may be executed independently of the geodetic, or may be based upon it. They may also be conducted on the principle of the Coast Survey, based upon a triangulation not always of geodetic value. Such a work has frequently been designated a "trigonometrical survey," implying areas of land, water, or both, in which the distances and directions are controlled by a triangulation.

There is a second class of surveys that consist largely of explorations, such as geological, agricultural, botanical, magnetic, etc., that require surveys of mensuration in greater or less detail for their comprehensive elucidation. But the mensuration does not give them their value; and it is desirable, therefore, that they should not be classed with work of that description. Aside from the fact that they are so comprehensive, a classification by themselves seems essential.

Surveys of mensuration may be divided into many subordinate classes, but they do not necessarily lose their general distinctive char-

acter in the process of division. Surveys for railroads, canals, or any works of construction on the land, are still topographic surveys. For many works of construction, the surveys must be of the most detailed character, and their execution is topographic work of the highest order. A great deal of confusion has undoubtedly arisen from the inadvertent use of the word "topography," restricting it to a description of the irregularities or relief of the earth's surface. Originally it was used to describe the artificial or cultural features only; but as the science of surveying was developed, and the relief became an important feature of topographic work, by almost universal practice, it was defined to include both artificial and natural features. To restrict its meaning now to the relief features will drive out the only word we have that represents the "face of the earth and all there is upon it," and gives us nothing in its place. Would it not be better to adhere to "relief of the topography," or "orography," or even coin a new word, than part with "topography" in its comprehensive sense?

It may be, as Mr. Baker states, that the object and purpose of topographical surveys is the production of topographical maps; but it is far from conclusive when he defines a topographical map as one "with an accuracy and detail sufficient for all general purposes," and that such a map "is not made for any one specific purpose, any more than a jack-knife is." "General purposes" is a very catching expression, but very hard to define in a topographic sense; it is probably a near kin to "ordinary" in the classification, but surely neither of them should be acceptable in defining or classifying an exact science. If the comprehensive meaning of "topography" is the true one, the topographic survey will serve all purposes in which topography may have a value, whether they are of the alleged "general" nature, or specific. But such surveys are necessarily expensive, and they are only undertaken by those nations that have use for such detailed results. Mr. Baker produces a table showing the scale of publication adopted for the general maps of European countries, leaving the inference that the surveys are made with this scale of publication in view. Such is the case in some instances; but the exceptions go to prove the rule, that, where a knowledge of all the topography is valuable, the working scales are three to six times larger than the general publication scales. This is substantial evidence that the detailed knowledge of the topography has a far greater economic value than the general knowledge. If it were not so, the great expense of the large-scale surveys would not be incurred.

In the following table I have added to Mr. Baker's figures the scales on which the surveys are first mapped.

	Publication Scales.	Scale of Surveys.
India.....	1:253440	$\left\{ \begin{array}{l} 1:63360 \\ 1:15840 \\ 1:3960 \end{array} \right.$
Russia.....	1:126000	1:21000
Germany.....	1:100000	1:5000 to 1:25000
Norway.....	1:100000	1:25000 " 1:100000
Portugal.....	1:100000	1:50000 and larger
France.....	1:80000	1:10000 " 1:40000
Austria Hungary....	1:75000	1:25000 " 1:28800
England.....	1:63360	1:2500 " 1:10560
Sweden.....	1:50000 to 1:100000	1:10000 " 1:50000
Italy.....	1:50000	1:10000 to 1:50000
Spain.....	1:50000	Field notes
Denmark.....	$\left\{ \begin{array}{l} 1:40000 \\ 1:80000 \end{array} \right.$	1:20000
Switzerland.....	$\left\{ \begin{array}{l} 1:25000 \\ 1:50000 \end{array} \right.$	1:25000 and 1:50000
Belgium.....	$\left\{ \begin{array}{l} 1:20000 \\ 1:40000 \end{array} \right.$	1:20000

It is more instructive as now compiled, and shows among other things that the scale of a map depends upon the character of the subject, as well as the purpose for which it is constructed; and we thus see how a complete topographic survey will furnish maps for

any purpose, and that, as the scale of the original surveys is reduced, their value becomes less. In England the large scales have superseded the small scales, and even in India there is no scale for the surveys smaller than one inch to the mile. In France, as recently as 1878, surveys of the whole country, to be published on 1:10000, were recommended by a commission specially organized to consider the subject. In nearly all these countries it will be observed that surveys are plotted on scales about three inches to the mile, and some on scales much greater.

A map is understandingly designated by the purpose for which it was compiled, as each purpose may require the representation of different features and greater emphasis on special features; and if referring to the land, they are topographical maps, as they represent topographic features, though perhaps not all of them.

I believe Mr. Baker is also in error in designating hydrographic and physical surveys under the head of nautical surveys. The latter class of work has its own meaning, is understood as being less rigorous than measurements upon the land, as, indeed, must be the case from the nature of the operations and the methods necessarily employed in their execution. It is more nearly a branch of hydrographic surveying, and is usually classed there or as exploration, although it may embrace a margin of land in the survey. The maps produced by this method are generally intended for nautical purposes, and its use is confined almost exclusively to the ocean and definition of the coast-lines.

Physical hydrography develops forces as well as forms: it seeks a cause for an effect, and thus perfects a hydrographic survey. In the same sense a geological survey would be the perfection of the topographic. But while similar in conclusion, they are different in method; for in the hydrography we measure the forces now at work, while in geology we must deduce them, and can but estimate their power. I would therefore reverse Mr. Baker's classification, and designate nautical surveys and physical hydrography as subdivisions of hydrography.

The preceding discussion relates to the determination of facts as they now exist. But surveying as generally understood embraces also the opposite of this, or the marking on the ground of lines previously agreed upon; which marks may in turn become facts in future surveys. This class of work is generally connected with engineering operations; but it is also the character of boundary work, and the usual operations in mining surveys. In the case of a railroad or canal, it consists in locating upon the ground the line that has been determined upon, with its cuts, embankments, etc., as marked upon the drawings made from the topographical survey; in the case of a boundary, to locate a point or line on a given meridian or parallel, or to run a line in a certain direction from a given point, or both; and in mining, the location of a new shaft or heading, or any of the many operations connected with the engineering work of a mine. Mr. Baker has grouped this class of work into two divisions,—"boundary" and "construction" surveys. But, it will be observed, the work is all of the same character, and might therefore with perfect propriety be grouped in one class, under the term already well understood by surveyors and engineers,—"location."

We thus have three divisions—mensuration, exploration, and location—in which may be grouped different classes of work according to the nature of the operation, and which would usually be subdivided by the purpose for which the survey was made, or the method upon which it was conducted, and sometimes a combination of both. These subdivisions will readily suggest themselves, but would make too long a list for insertion.

In conclusion, permit me to add a few words on what Mr. Baker declares "a well-recognized principle, especially among engineers, that of two maps, or works of any kind, made for the same purpose, and serving that purpose equally well, that one is best which is cheapest." This implies, that, of two things exactly alike, the one that costs the least is the best. If they are alike, the price cannot affect their utility for the purpose for which they were designed, though one cost ten times the other. The cheapest would probably be most satisfactory to those who had to pay the bills; but, if both were the same price, there could be no choice for any reason. We may readily conceive, however, that if bids were offered to make two maps or works of any kind, that should serve a speci-

fied purpose equally well, the cheapest would be most favorably considered in the majority of cases; but, if the work was to be executed by two bodies of men of like skill and experience, we should have to conclude that one party was seeking an unusual profit, or that the other did not intend to live up to the contract, for it is inconceivable that two bodies of intelligent men, honest and experienced in their trade or profession, would execute a similar work with any great variation in the cost.

HERBERT G. OGDEN.

Washington, D.C., April 9.

English Examinations.

A SHORT time since, the public was greatly amused at a book containing a collection of ludicrous mistakes made by children in their examination-papers. Much merriment was excited by these poor little attempts at wisdom, and doubtless not a few persons laughed at the blunders of their own children, not perhaps understanding that some of this stupidity might have been inherited. Nor did the teachers who culled these blighted flowers seem to realize that many a thoughtful reader might be in doubt as to whether such evidence was intended to prove the incapacity of the children to learn, or the inability of the teachers to teach. Then human nature asserted itself in a cry of derision at the whole system of school education, and this was as manifestly uncalled for as the first outburst of cackinnation.

The method of examining college and university students is another serious matter that demands our attention. At the moment, the main agitation is in England. The recent expressions of opinion by eminent Englishmen as to the results and tendencies of the examination system there in vogue are appalling. There can be no doubt that the matter is one of grave importance. The examination system of England compels men to cram,—to become mere memorizers of facts, to substitute a hasty and temporary knowledge of these for reasoning, and to become learners of other men's ideas and discoveries to the exclusion of the ability to discover facts and create ideas for themselves. The result of this form of education is to make absorbers and not producers of knowledge,—as Shakspeare says,

"Small honor continual plodders ever won,
Save bare authority from others' books."

Such a condition is one of intellectual serfdom. The individual becomes dependent on others for advance in knowledge. His power to originate is not developed. He becomes a mere book, except that he costs more than a book, and is worth far less, less convenient to handle, less complete, and generally of far less use,—a kind of an old edition, lacking many pages, index, and author's name, badly bound, and full of omissions and errors.

The effects of the English examination system are readily seen in the many "cram" books that are published in that country, and which lack system and didactic worth. Most of them are professedly helps in preparing for examinations. The virus is also at work in this country, and earnest educators should lose no time in resisting its inroads. The result of this agitation is an outcry of the thoughtless against examinations of any kind. This, I think, is wrong. That bad effects are produced by certain kinds of examinations is very true; but that all examinations have therefore an evil tendency, I emphatically deny. So far, the consideration has not extended as thoroughly as it should to the nature of the examination from a didactic standpoint. That a certain class of examinations yield bad results, proves, not that all kinds of examinations are worthless, but that that particular kind of examination does not give satisfactory results. That may be because the examination is wrong in principle, because it is not the one called for by the work done, because it is imperfect, because it does not really show that the student knows any thing about the subject, nor because the examiner does not know how to examine. I venture to say that a considerable number of the teachers in colleges and universities, although men of undoubted learning and ability, and in many instances investigators of acknowledged reputation, do not pay much attention to the pedagogical side of their subjects, and, least of all, do not attempt to make a study of the principles and methods of examining. The science and art of examining are

really most important branches of pedagogy. Good examiners are rare, even among a body of eminently successful teachers.

Varied as may be the questions, ingenious and cunning as may be the side-issues woven in and easily overlooked, skilful as may be the attempts to trip the student, hidden as may be the pitfalls and snares, (and how quickly does an old student recognize them!) the average examination-paper calls for but little more on the part of the student than an accurate memory of facts, and some little ingenuity in twisting them. By it may be ascertained the nature and amount of facts that the student has gained. By it cannot be ascertained the increase in intellectual power of the student, his ability to apply these facts, the nature of the effect of the particular study upon his intellect, his ability to proceed independently in the study of the subject, the development of original thought in him, his interest in the subject, his perception of the value of the subject to him, or whether he has been imbued with the true spirit of that subject. Has he received "sacks full of dry leaves," or has he seen "the living, growing tree"? Has the study been presented to him as the mortal, short-lived body, or the immortal, upward-soaring soul? The student tells about the odor, color, taste, and form of substances he has never seen, and of physical phenomena he has never observed. He quotes from books he has not read, cites facts which he cannot establish, defends theories in which he does not believe, and proves to the satisfaction of the examiner statements which he doubts at heart. If the examination does not show more than a memorized knowledge of facts, it amounts to the old *a b, ab; b e, be*; it is a waste of time and energy; it's a hypocritical farce. The young student feels it to be one, and the older student and the teacher know that it is one.

Numerous remedies have been prescribed, and some are certainly excellent. Examining committees are a step in the right direction. If each member questions the student, the result will be that he will soon show what real progress he has made in the subject, and also how well he has been taught. But these committees, while good in theory, rarely carry out their work with much success, for a natural delicacy is felt in pushing hard the student of a colleague; and the majority of the committee-men have, as a rule, quite enough to do in examining their own classes. A bright, keen man of business often makes a good examiner. He does not know much about the subject, and really wants information. To enlighten such a man, and satisfy his inquisitiveness, the student has to assume the part of teacher, and soon shows if he really knows any thing about the subject beyond a mere parrot-like repetition of disconnected facts. Such an examination, however, is always incomplete, and often too long. Neither can such an examiner go through a whole class.

As in all other matters, to make examinations of value, the subject must be investigated and the principles found out. We must know what objects are to be attained, and then we must follow, as best we can, not an empirical routine, but a philosophical procedure; not like professors in the University of Laputa, but remembering that we live in the nineteenth century.

The mind acts successively in three ways; viz., by observation, comparison (judgment), reason. These are broad divisions, and may of course be subdivided, but it would be beyond the scope of this paper to go into the details of classification. Having obtained facts by observation (and I include here not alone the physical and chemical properties of unorganized and organized matter, but statements of events, and of subjective data, etc., such as may be obtained by reading), the mind compares the mental images so gained, and perceives wherein they resemble each other and wherein they differ. The next step is reasoning, — inductive when the step is from the particular to the general, and deductive when it is from the general to the particular. These four actions of the mind should always be tested in an examination, that it may show what effect the study of the subject has had on these four typical mental processes, and how well the mind has been trained to act in this fourfold way by the study of the subject.

A student may tell us all about Napoleon and Washington as glibly as if he were reading from a book. But let him be asked wherein these two men resembled each other, and wherein they differed from each other, and the glibness disappears like a flash; for the mind must now apply its facts, compare the images, and

note similarities and differences. The student begs for time to think, — a sad reflection on his previous answers. I will also include memory as a faculty of the mind. It should always be tested by an examination, but it is a very difficult matter to say just what value is to be placed on it. It is a treacherous and elusive faculty. It may be temporarily active, yet in the main torpid. It may be slow, yet lasting. Its absence is a fault, its presence is a danger. It has many forms, and plays many a deceitful rôle. While memory is the antecedent necessity of thought, it is still a subservient faculty. It is the useful slave, but a tyrant when master. I would make it work to its full limit, yet not honor it with medals. It is my tool, my library, my sword, my medicine, but it is not *I*. The wise teacher and examiner know well how to bring out its full value, and yet not to be led astray by its dazzle. Readiness of perception should also be taken into account, but this is still more difficult to value than memory. Men reach their objective aims in different ways, some quickly, some slowly. The important point is to be sure that they really do attain them.

The difficulty with the examinations in vogue in England, to judge from the complaints recently published, is that they fall too entirely under the first head. They test the students' powers of observation alone, and allow the substitution of memorizing for thinking. While they fall under observation, these examinations do not at all test or train the students' real or full powers of observation. In physical science, for instance, the school-knowledge of the properties of matter learned from books is not to be compared with the worth of the same knowledge gained by actual experiment on the part of the student. No amount of "cram" can ever teach a student the possible differences and similarities between the images that his memorizing of facts has stamped on his mind with more or less vividness and durability. The skilled examiner can ring changes on them without end. Nor can "cram" help to any extent in reasoning. Inductions and deductions can be ground out in an endless stream, even by the average examiner; but the experienced questioner, studying the mind before him, as one dissects some delicate organism, tests its working, examines its products, and notes its behavior under varying conditions, forming a fair opinion as to what it is intended to do, and how well it may be expected to do it. Nor need any two examinations ever be alike; assuming, of course, that the teacher is himself a real teacher, and not a mere animated phonograph.

Should examinations be so conducted as to test the mind in the way indicated, there would be of course a great turmoil, for hundreds of students would fail to pass. As the blame for the failure of the student to understand what he studies is usually, and to a certain extent with justice, thrown on the teachers, there would be another wild outcry on their part. All of this agitation would result, however, in what is really demanded, — a form of examination that should show the condition and working of the student's mind as affected by each particular subject, and that should also demonstrate the ability of the teacher, not only to impart information, but to develop minds by means of his particular subject. It will require great courage on the part of teachers to give examinations that shall show whether the students really know any thing about the subjects of their studies. It will be difficult to assign marks to such examinations that shall be entirely satisfactory or exact; but the education of the student in facts and principles, the development of his mind by them, and his ability to observe for himself and to use his knowledge in the production of new knowledge, will be attained. These, and not the representation of mind-power by figures, when no unit of mind-power is known, are the real objects of education; for the ideal man of to-day is not he who simply acquires knowledge, but he who makes knowledge. Production, not absorption, is the standard by which men are to be judged. Knowledge alone is not power, it is the ability to use knowledge that constitutes power.

Examining, or testing the condition and action of the mind, is a subject of great pedagogical importance. It certainly seems evident that the present agitation about examinations will end in proving, not that examinations are of no value, but that many examiners do not yet fully understand the facts, principles, and methods of examinatory science.

PETER T. AUSTEN.

New Brunswick, N.J., April 13.

GUARANTY INVESTMENT COMPANY

CAPITAL \$250,000.

Hon. ALBERT H. HORTON (Chief Justice, Kansas Supreme Court), Topeka, Kan., Pres't.

7% Guaranteed Farm Mortgages 7%

The Company calls the special attention of Investors to the following points :

- I. All loans guaranteed and interest payable semi-annually at the Importers' & Traders' National Bank, New York.
- II. Unusual fulness of information, not only about the security itself, but about the general development of the section where the farm is located.
- III. An examination each year of the general business of the Company and the Mortgages themselves by a COMMITTEE OF INVESTORS sent for the purpose.
- IV. Many hundred Mortgages taken and NOT A SINGLE FORECLOSURE.
- V. Exhibitions in New York at frequent intervals, of Kansas and Nebraska Farm Products. The Exhibition at the American Institute in the fall of 1888, received the *HIGHEST AWARD* of superiority.
- VI. Monthly Bulletins giving full information about all Mortgages offered for sale.

Address for Monthly Bulletin and Investors' Committee Report for 1888,

HENRY A. RILEY, General Eastern Manager, 191 Broadway, N.Y.

GEOLOGY AT A GLANCE.

Ives Strata Map of part of the United States of America and Canada,

In which the Architecture of the Earth's Crust is Graphically Exhibited, Illustrating Fundamental Facts alike of

STRUCTURAL GEOLOGY AND PHYSICAL GEOGRAPHY.

The Strata Map is a device for the more efficient teaching of Physical Geography and Elementary Geology in Schools. It consists of a series of Ten Superimposed Maps, of DIFFERENT COLORS, representing the several geological formations of the district, enclosed in a glazed frame, the whole hinged to ad-

mit of examination in detail. By its means *superposition, denudation, and outcrop* of strata are graphically exhibited, with the phenomena of *escarpments, outliers, inliers, dip, strike, conformability, &c.*, and the Cards may be bent to show *synclinal or anticlinal* folds.

OPINIONS OF EMINENT GEOLOGISTS.

Yale University. Professor James D. Dana.
"Well fitted for the use of instruction in the science."

Professor Addison E. Virrill.
"It will be of very great advantage in the teaching of geology."

Harvard University. Professor N. S. Shaler.
"An extremely useful adjunct to our means of illustration."

Johns Hopkins University. President D. C. Gilman.
"Wherever American geology is taught your map should be a part of the apparatus."

Pennsylvania University. Professor Geo. A. Koenig.
"The map will be of special use in schools, which can only devote a short time to the study of Geology."

Michigan University. Professor Alexander Winchell.
"It seems to me that the device will commend the study of Geology to many persons who might otherwise regard the subject as difficult and uninviting. The work prepared by Mr. Ives ought to be used extensively in American schools."

Cornell University. Professor H. Shaler Williams.
"A valuable aid to teachers of geology as a means of graphically representing the grand facts of stratigraphy in the Eastern United States."

Columbia College, New York. Professor J. S. Newberry.
"A valuable aid in teaching geology, giving as it does to the student a clear idea of the superposition of the different geological systems at a glance."

Dartmouth College, Hanover, N. H. Professor C. H. Hitchcock.
"Am satisfied that its use will greatly assist students to understand the geological structure of the country."

Academy of Natural Sciences of Philadelphia.

Professor Angelo Heilprinn
"The representation of Strata, as imposed one upon the other, by means of cardboard is certainly a good plan, for apart from rendering more intelligible the general expressions of the Map, it permits of ready alteration and the possibility of constantly bringing the map up to date, in other words to make it conform to more recent discoveries."

Boston Society of Natural History.

Professor Alpheus Hyatt.
"Your map representing superposition and the various phenomena of geological science, so far as the distribution of rocks on this continent is concerned, has greatly interested me. I think that in the hands of a good teacher it would prove an efficient and useful adjunct in the teaching of geology."

American Museum of Natural History.

Professor R. P. Whitfield.
"In the direction of a want long felt by Teachers of Geology and will undoubtedly be appreciated by them as well as by the student."

U. S. Geological Survey.

Major J. W. Powell, Director
"After examination I am able to state that the work has been executed with care and fidelity, and I believe it will be a valuable aid to teachers."

New York State Survey.

Professor James Hall, State Geologist
"I believe that maps constructed upon this method would be extremely useful in the hands of competent teachers."

Pennsylvania Survey.

Professor J. P. Lesley, State Geologist.
"A piece of new and useful apparatus for teaching Geology, by representing to the eye of the student the areas of superimposed formations. I cordially recommend it to teachers and students."

New Jersey Survey.

Professor Geo. H. Cook, State Geologist.
"It is very neatly done and must prove a great help to intelligent teaching and studying of Geological Science."

SIZE 30x24 INCHES. PRICE \$17.50.

PUBLISHED AT THE OFFICE OF "SCIENCE," 47 LAFAYETTE PLACE, NEW YORK, N. Y.

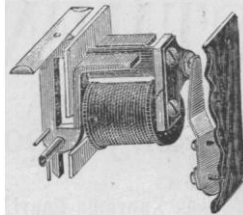
Dry Goods Openings

are now all the style. Small dealers make a great ado about the opening and display of each season's novelties. It belongs to the metropolis of the nation and to the great business houses on its broad streets to have a continuous series of openings the year round. Of the limited number of truly great dry goods establishments in New York, Messrs. James McCreery & Co., in the matter of original exhibits combining novelty, originality, and exclusive design, lead all the rest. This enterprising firm have a well earned reputation for integrity in their business dealings, remarkable quality in the goods offered for sale, and moderation in price. Their constantly recurring advertisements in this paper are truthfully written and their representations can be depended upon.

Schools.

CONNECTICUT, NEW HAVEN,
MRS. CADY'S SCHOOL FOR YOUNG LADIES.
Prepares for Smith and Wellesley, and admits to Vassar by Certificate. Circulars. Early application necessary.

NEW JERSEY, PLAINFIELD.
THE CHESTNUTS.—Parents with daughters to educate, or orphan girls with companion, may find a comfortable home, with school instruction by applying to Miss E. E. Kenyon.



A
★
DROP
IN THE
PRICE
★
OF

**GRAVITY
DROP
ANNUNCIATORS.**

**DON'T FORGET THE
DUST-PROOF BELLS.**

**HAZAZER & STANLEY,
32 Frankfort Street, N. Y.**

Any one who will have the following blank filled out by a responsible Newsdealer, and mailed to us, will be allowed a three months' subscription to *Science*.

**N. D. C. HODGES,
47 LAFAYETTE PLACE, NEW YORK.**

1889.

To the *News Company.*

*You may add to my regular order five copies of SCIENCE
each week (returnable).*



BRANCH AT 728 CHESTNUT ST.
PHILADELPHIA, PA.

JOHN HASTINGS = A=R=MART = JOS=TRIPP.
Pres't. Gen-Manager. V-Pres't.

**ENGRAVING FOR
ALL ILLUSTRATIVE
AND ADVERTISING
PURPOSES**

67-71 PARK PLACE
NEW YORK



**GOOD NEWS
TO LADIES.**

Greatest inducements ever offered. Now's your time to get up orders for our celebrated **Teas and Coffees**, and secure a beautiful Gold Band or Moss Rose China Tea Set, Dinner Set, Gold Band Moss Rose Toilet Set, Watch, Brass Lamp, or Webster's Dictionary. For full particulars address **THE GREAT AMERICAN TEA CO.**
P. O. Box 328. 31 and 33 Vesey St., New York.

16 PAGES. THREE 16 PAGES.

Hundred Thousand new subscribers for *The Family Journal and Ladies' Companion* wanted. It is the most interesting and instructive paper ever issued. Subscribers will receive during the coming twelve

MONTHS

novels written by American Authors, complete in each three numbers. The story of popular works of fiction will be retold by a novel reader, the most interesting and unique feature ever introduced in any publication, giving the substance of popular and standard books by famous writers in a space easily read by the busiest people. We have engaged

FOR

this work a widely known and popular writer. Comments on Current Events, Fashions, New and Original Ideas and Designs for Ladies' Fancy Work and Household Decoration, Letters from Correspondents and their Answers. The colleges and seminaries of the United States will be treated one each month in an illustrated article, showing the particular advantage of each, cost of attendance, etc. Invaluable to parents having sons or daughters whom they desire should receive the advantages of a higher education than the ordinary school affords. Articles on Painting and Drawing, giving home instruction by a well-known artist. A trial subscription of this elegant paper will be sent to any address, three months for

TEN CENTS.

Liberal pay for literary work adapted to our columns, and for new and original drawings, designs and ideas on any subject which we can use.

Premium List the most complete in the world. We offer inducements to club raisers and agents approached by no other publishing house. The celebrated Gilbert Cut Waist Linings, which we send post paid to any one sending us two yearly subscribers at 50 cents each is alone worth 75 cents.

12 Sent to any address, post paid one year, 50 cents; six months, 25 cents, and a three months' trial subscription for only 10 cents.

TRY IT! TRY IT! TRY IT!

and you will become a permanent reader. Address:

**John L. Douglass, Publisher,
322 Broadway, N. Y.**

**SPECIAL
Importation Sale**

The following unusual value in short ends and Special purchases are worthy of your attention

\$50 Suits	AT \$35
\$45 Suits	
\$42 Suits	
\$40 Suits	
\$14 Trousers	AT \$7
\$12 Trousers	
\$10 Trousers	
\$9 Trousers	

People who appreciate FINE Clothing at unusual moneys worth will please notice the above.

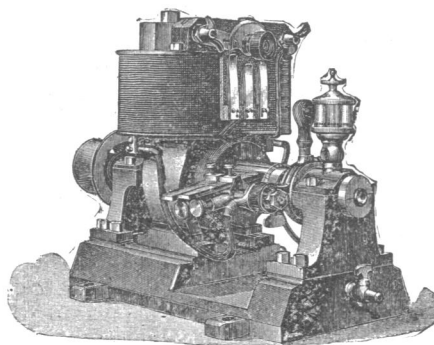
E. O. THOMPSON,
Fine Merchant Tailoring,
245 BROADWAY.

Extract of Letter from Merchant Tailor:

"I am informed that your knowledge of cutting is far ahead of all others—could kind words and a compensation induce you to teach me your system?"

C. & C. ELECTRIC MOTOR COMPANY.

Electric Motors
FOR
Arc and Incandescent Circuits, Most Economical Motor on the Market.
Regulation Perfect.
Motors Designed for all Power Purposes.



OFFICE and MANUFACTORY:
402 and 404 Greenwich Street, New York City.

New England Office, 19 Pearl St., Boston.

Philadelphia Office, 301 Arch St.

Western Office, 139-141 Adams Street Chicago.

Southern Office, 25 Carondelet Street, New Orleans.

THE American Bell Telephone COMPANY. 95 MILK ST., BOSTON, MASS.

This Company owns the Letters Patent granted to Alexander Graham Bell, March 7th, 1876, No. 174,465, and January 30, 1877, No. 186,787.

The Transmission of Speech by all known forms of ELECTRIC SPEAKING TELEPHONES infringes the right secured to this Company by the above patents, and renders each individual user of telephones, not furnished by it or its licensees, responsible for such unlawful use, and all the consequences thereof and liable to suit therefor.

ESTERBROOK'S STEEL PENS.

OF SUPERIOR AND STANDARD QUALITY.

Leading Nos.: 048, 14, 130, 135, 239, 333
For Sale by all Stationers.

THE ESTERBROOK STEEL PEN CO.,

Works: Camden, N. J. 26 John St., New York.

Old and Rare Books.

A. S. CLARK, Bookseller,
34 PARK ROW, NEW YORK CITY.

A Gleaner in the By-ways of Literature. Results of Gleaning found in Catalogues issued from time to time.

CATALOGUE NO. 27 NOW READY.

BACK NUMBERS and complete sets of leading Magazines. Rates low. AM. MAG. EXCHANGE, Schoharie, N.Y.

H. WILLIAMS,

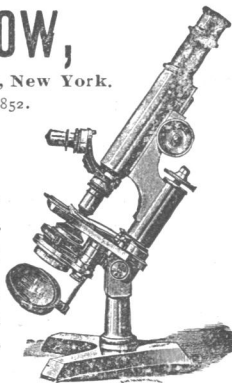
Dealer in Old Magazines, Reviews, &c. Scientific periodicals a specialty. 39 Macdougall St., N.Y.

Scientific Apparatus.

J. GRUNOW,
621 Sixth Avenue, New York.
Established 1852.

MAKER OF

Microscope Stands, Oil Immersion Objectives and Abbe Condensers for Bacterial and Histological work, of Objectives, Camera Lucida and other accessory apparatus.



IMPROVED OIL LIGHT MAGIC LANTERNS.

Also Lime and Electric Light Apparatus, and mechanical, plain, and fine colored views.

J. B. COLT & CO., Manufacturers,
No. 16 BECKMAN STREET, NEW YORK.

MAGIC LANTERNS Stereopticons and the Best Views for Public, Church, Home, and Scientific Exhibitions. Best apparatus, new views. Largest stock. Reduced prices. 24 Years' Practical Experience. Illus. Catalogue Free.

GEO. H. PIERCE,
136 S. Eleventh St., Philadelphia, Pa

ELECTRICAL TESTING BUREAU,

Johns Hopkins University, Baltimore, Md.

Resistance Coils and Boxes Compared.
Am meters and Volt meters calibrated.
Condensers standardized.
Primary and Secondary Batteries Tested.
Efficiency of Dynamos and Motors Determined.
Insulation of Cables and Wires Tested.
Etc., Etc.
Circulars describing Methods Used, Prices, Etc., sent on Application.
Address as above.

MORRIS EARLE & CO.
SUCCESSORS TO

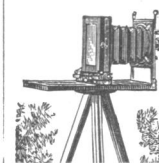
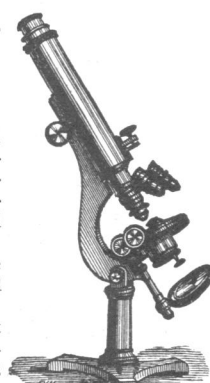
R. & J. BECK,

1016 Chestnut Street Phila

Microscopes and all Accessories and Apparatus. Photographic and Photo-Micrographic Apparatus and Outfits.

Spectacles, Eye Glasses, Opera and Marine Glasses, etc.

Illustrated Price List mailed free to any address. Mention SCIENCE in corresponding with us.



E. & H. T. ANTHONY & CO.
591 Broadway, N.Y.

Manufacturers and Importers of PHOTOGRAPHIC INSTRUMENTS, Apparatus and Supplies of every description. Sole proprietors of the Patent Detective, Fairy, Novel, and Bicycle Cameras, and the Celebrated Stanley Dry Plates.

Amateur Outfits in great variety, from \$9.00 upward. Send for Catalogue or call and examine. More than 40 years established in this line of business.

A BOOK FOR THE TIMES!

NEW EDITIONS!

Laidlaw's Constitution of the United States and the Declaration of Independence, in English, French, and German, with notes. Sold by all booksellers, or by the publishers, LAIDLAW BROS. AND CO., 137 W. 41st St., New York.

Second and Revised Edition, in cloth - - - - - 50c. postpaid.

Third Edition, in paper - - - - - 25c. postpaid.

R. ELLIS & CO.

BUSINESS, HOTEL AND PATENT BROKERS,

AUCTIONEERS, ETC.

No. 176 BROADWAY,

Room 46.

New York.

CLIENTS Advised free of charge.

The Mutual Life Insurance Company

OF NEW YORK.

RICHARD A. McCURDY, PRESIDENT.

ASSETS - - - \$126,082,153 56

The Largest and best Life Insurance Company in the World.

The New Business of the Mutual Life Insurance Company in 1888

Exceeded \$103,000,000.

Its Business shows the Greatest Comparative Gain made by any Company during the past year including

A gain in assets of	\$ 7,275,301 68
A gain in income of	3,096,010 06
A gain in new premiums of	2,333,406 00
A gain in surplus of	1,645,622 11
A gain in new business of	33,756,792 85
A gain of risks in force	54,496,251 85

The Mutual Life Insurance Company

Has Paid to Policy-holders since Organization \$272,481,839 82.

Arnold, Constable & Co. SPRING STYLES DRESS FABRICS.

Plain and Hair-Line Batiste Cloths,
Printed Laines, Fancy Mohairs,
Cheviots, Tweeds,
for Steamer and Travelling Dress.
Checked and Striped Suitings,
Broche and Embroidered Robes,
Cashmeres d'Ecosse, Henrietta Cloths,
IN NEW COLORINGS.
FOR STREET AND EVENING WEAR

Broadway & 19th st.
New York.

IMPROVING THE MEMORY PICK

and facilitating the acquirement of knowledge by lectures and correspondence. Classes forming. "MEMORY and its Doctors," from Simonides to "Loisette," mailed for 10 cents.
DR. PICK, 24 Union Square, N. Y. City.

FOOD ADULTERATION

And its Detection. With photomicrographic plates and a bibliographical appendix. By J. P. Battershall. 328 pages, 8vo, cloth. Price, \$3.50. Circulars and Catalogues on application. E. & F. N. SPON,
12 Cortlandt St., New York.

PATENTS.

During April and May my fees due only on allowance if desired. Write

WM. H. BABCOCK,
513 Seventh St., Washington, D.C., P. O. Box 220.
Formerly Examiner in Patent Office.
THIRTEEN YEARS' PRACTICE.

A SEASONABLE FABRIC.

This refers to a Wash Silk, one that can be washed without the least injury to the fabric, either in appearance or color.

The lack of just such a material has long been felt, and its introduction will undoubtedly be received with satisfaction.

Wash silks are light in texture, tasteful in design and coloring, and very durable, being thus eminently adapted for Spring and Summer Wear.

We are showing exclusive styles.

JAMES McCREERY & CO.

BROADWAY AND ELEVENTH STREET,
NEW YORK.



KIMBALL'S STRAIGHT CUT CIGARETTES.

Unsurpassed in quality.
Used by people of refined taste.
Highest award at Brussels, 1888.
The finest smoking mixtures are of our manufacture.
Fifteen First Prize Medals.
WM. S. KIMBALL & CO.
Rochester, N.Y.

ESTABLISHED 1859.

H. A. DREW,

Commercial Printer,

5 Clinton Place, near Broadway,
New York.

Wedding Orders, Souvenirs, Invitations, Orders of Dance, etc., etc., done in the latest and most elaborate styles, at reasonable prices.

All Favors promptly attended to.

THE CHEQUE BANK LIMITED.

ESTABLISHED IN LONDON, 1873.

CHIEF OFFICE, 4 Waterloo Place, Pall Mall, London.

TRUSTEES:

The Right Honorable JOHN BRIGHT, M.P.

The Right Honorable EARL BEAUCHAMP.

Bankers: Bank of England.

The Capital of the Bank and its Guarantee Fund of 50% is invested in Government Securities.

The Bank does not discount Notes or Bills, nor speculate, but loans its Deposits against Government Securities, thus making the Cheque Bank Cheques EQUAL TO CASH—as Bank of England Notes are.

The Cheque Bank issues Cheques singly or in books from ONE POUND upwards, for the use of Travelers, and for others remitting money to Europe, available in every town in England, Scotland, Ireland, and Wales. In every town of Europe, and all other parts of the world. Cheque Bank Cheques are accepted as Cash by all the British Government Offices.

VISITORS TO THE PARIS EXHIBITION this summer can get the Cheque Bank Cheques cashed at 50 Banking Houses in Paris.

Travelers and others holding Cheque Bank Cheques can have their mail matter addressed to them, care of the Cheque Bank, London, who will take charge of the same and forward to any address.

For Hand-Book containing List of upwards of 2000 of the principal Banking Houses throughout the World who Cash the Cheque Bank Cheques, and for all information, apply to the AGENCY,

CHEQUE BANK, Limited,

UNITED BANK BUILDING,

2 Wall St., New York.

E. J. Mathews & Co., Agents.

REFERENCES BY PERMISSION:

JNO. W. MACKAY, Esq., President Commercial Cable Company, Mackay-Bennett Cables, New York.

F. O. FRENCH, Esq., President Manhattan Trust Co., New York, and others.

KNABE

PIANOFORTES.

UNEQUALLED IN

Tone, Touch, Workmanship and Durability.

WILLIAM KNABE & CO.

NEW YORK: No. 112 Fifth Av., above 16th St.

BALTIMORE: Nos. 22 and 24 E. Baltimore St.

WASHINGTON: No. 817 Market Space, Penn. Av., near 9th St.

WHY YOU SHOULD USE

Scott's Emulsion

OF Cod Liver Oil WITH
HYPOPHOSPHITES.

It is used and endorsed by Physicians because it is the best.

It is Palatable as Milk.

It is three times as efficacious as plain Cod Liver Oil.

It is far superior to all other so-called Emulsions.

It is a perfect Emulsion, does not separate or change.

It is wonderful as a flesh producer.

It is the best remedy for Consumption, Scrofula, Bronchitis, Wasting Diseases, Chronic Coughs and Colds.

Sold by all Druggists.

SCOTT & BOWNE, Chemists, N.Y.